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SOLAR-CYCLE DATA FOR CORRELATION WITH RADIO PROPAGATION PHENOMENA

Close correlation has been established between cyclic changes of solar activity and numerous high-frequency radio propagation phenomena, - notably the critical frequencies of all ionosphere layers, upper-limit sporadic-E reflection frequencies, F2-layer maximum-usable-frequency factors, and times of usefulness of fixed frequencies over various transmission paths. For the convenience of research workers in this field, since no up-to-date compilation of this type of data is available for recent years, this report affords graphical and tabular presentation of the more pertinent solar-cycle data for correlation with radio propagation phenomena together with references for supplementing them by other available material.

The best record of solar activity extending over more than a single solar cycle is the series of relative sunspot numbers begun by R. Wolf ("Mitteilungen über die Sonnenflecken," Naturforschende Gesellschaft in Zurich Vierteljahrsschrift, 1856-1865), and continued by Wolfer and Brunner at Zurich. These numbers are obtained from solar observations of individual sunspots and sunspot groups made at various observatories, reduced to a common basis by means of the formula:

$$\text{Relative sunspot number} = C(10G + N)$$

where G is the observed number of sunspot groups, N the total observed number of sunspots, either singly or in groups, and C a factor, which depends upon the type of telescope used, the seeing conditions, and other factors affecting the observations, to bring the observations into best general consistency with Wolf's original observations. The factor 10, which multiplies G, was decided upon by Wolf in order to give greater weight to the large active solar areas constituting spot groups than to small spots of short duration, so that the relative sunspot numbers might serve as an index of general solar activity. It is both remarkable and fortunate that this rather arbitrary choice of representation, made nearly a century ago, has since afforded excellent correlation with a large number of diverse phenomena whose variations may be expected to possess causal relationship with the variations of solar activity.

Wolf began systematic observations of sunspots in 1849, and made an extensive compilation of existing previous observations. These go back as far as 28 B.C., when there is record of observation of sunspots by the Chinese. Very scanty data exist prior to 190 A.D.

Thereafter, the data are somewhat more plentiful, although not continuous. More exact data, from which Wolf was able to establish times of minima and maxima with a precision of ± 2 years, begin with the observations of Fabricius in 1610. Beginning of the continuous series of mean monthly relative sunspot numbers was made possible by the observations of Staudacher of Nuremburg during the period 1749-1799. Overlapping of the period of these observations with that of observations by Flaugergues (179401830), and successive overlapping of observation periods of others, - Tevel (1816-1836), Adams (1819-1823), Arago (1822-1830), and Schwabe (1826-1855), - enabled Wolf to compare them, successively, with each other, and finally, with his own observations, thus reducing all to a common standard. At present, this series is continued, not only by observations at Zurich, but by those of a large number of independent observers, whose values are brought into the best mutual agreement by suitable choice of the factor C, then averaged to form an international relative sunspot number.

A resume of Wolf's work is given by H. Fritz ("Die Perioden solarer und terrestricher Erscheinungen", Vierteljahrsschrift der Naturforschenden Gesellschaft in Zurich, H.1, 1893, a translation of which has been presented in the U.S.W.B. Monthly Weather Review, 56, Oct. 1928, p. 401), together with a great deal of supplementary terrestrial data, which, showing correlation with solar activity, are useful in inferring its variation during periods when sunspot data were not available. Because of the close correlation of auroral displays with solar activity, the auroral data presented in this report, some as early as 465 B.C., are particularly valuable. Other notable reports containing supplementary terrestrial data for the estimation of solar activity during very early periods are those of H. W. Clough ("The Long Period Variations in the Length of the Eleven-Year Solar Period, and Concurrent Variations in Terrestrial Phenomena," Bull. Am. Meteorological Soc. 24, April 1943, p. 154) and A. E. Douglass ("A Study of Cycles", Carnegie Inst. of Washington, 1936).

Tables of monthly average relative sunspot numbers for 1749-1938, smoothed monthly values for the same period, and times of maxima and minima since 1610, are given by W. Brunner, (Terr. Mag. and Atmos. Elec., 44, 1939, p. 249). Additional sunspot data are at present regularly issued in the following journals: Astronomische Mitteilungen (Zurich), Monthly Notices of the Royal Astronomical Society, U.S.W.B. Monthly Weather Review, Terrestrial Magnetism and Atmospheric Electricity, Cosmic Data (U.S.S.R.), Journal of the Astronomical Society of the Pacific.

The Department of Terrestrial Magnetism, Carnegie Institution of Washington, issues monthly relative sunspot numbers from American observers, which are the means of daily median values throughout the month, of twenty-eight (or fewer) independent observers. These are usually available about a month after the observations are made, - a very considerable time earlier than the availability of international relative sunspot numbers.

Daily observations of sunspots are regularly reported to the Interservice Radio Propagation Laboratory by the U.S. Naval Observatory, Mt. Wilson Observatory, and the McMath-Hulbert Observatory, for use in radio propagation work. These reports are ordinarily received on the day of observation. By using the conversion factor, C, appropriate to each case, approximate values of current relative sunspot numbers may be obtained from them.

Table I of this report presents monthly mean relative sunspot numbers beginning with the year 1749. These are identical with those given by Brunner (loc. cit.) from 1749-1938. The values through December 1940 are international relative sunspot numbers. Values for January 1941 through December 1944 are Zurich final numbers. Later values are Zurich provisional numbers.

Table II presents twelve-month running-average relative sunspot numbers obtained from the data of Table 1. These are very nearly, but not quite, identical with the smoothed numbers given by Brunner (loc. cit.). The twelve-month running-average sunspot numbers of Table II are not only useful in obtaining a smoothed curve of solar activity, but are of particular use in direct correlation with twelve-month running-average values of ionospheric data, where basic solar-cycle trends are desired apart from seasonal effects.

Figs. 1 through 21 present the data of Tables I and II graphically, the solid curve representing the twelve-month-running-average sunspot numbers of Table II, the discrete points representing the monthly average values of Table I.

Table III presents the averages of consecutive pairs of values from Table II, over the period through which ionospheric data are available. This gives a set of values representative of twelve-month-running-average sunspot numbers centered at the middle of each month, rather than between consecutive months. Such values are useful when determining basic solar-cycle trends of ionospheric data for a particular month, and, in comparison with the values of Table I, in explaining possible abnormalities in behavior which may be associated with temporarily abnormal solar conditions.

Errata in Table II

	1770	1833	1834	1835	1837	1838	1846	1847
Dec.								
Jan.		12.4		25.3		123.6		65.7
Feb.	110.7	11.8		29.6		119.0		66.2
Mar.		11.5		34.2		114.4		73.4
Apr.		11.8		41.6		112.5		77.9
May		10.7		47.5		109.8		88.2
June		10.0		53.3		107.3		94.8
July		8.5		56.8		103.1	61.5	
Aug.		8.0		63.6		100.0	63.5	
Sept.		8.2		70.5	127.1		63.0	
Oct.		7.6		77.1	127.6		64.8	
Nov.		7.5	20.3		126.7		62.8	
Dec.		7.1	23.2		128.9		64.0	

	1867	1868	1869	1870	1875	1876	1893	1894
Dec.								
Jan.		18.3		107.0		11.6		87.2
Feb.		20.3		113.1		11.8		88.6
Mar.		22.8		119.3		11.3		83.7
Apr.		25.6		123.9		12.0		82.7
May		29.6		131.1		12.1		82.4
June		33.8		137.0		11.5		80.8
July		37.3		139.1	17.1			78.0
Aug.		41.1		140.0	17.0			76.3
Sept.		44.7	79.9		16.4			74.9
Oct.		46.9	88.8		16.2			75.6
Nov.	13.9		98.7		14.0			75.2
Dec.	15.9		104.7		13.5		86.3	

SOLAR CORONAL INTENSITIES OBSERVED AT CLIMAX, COLORADO

In table 75 the intensities of the green (λ 5303A), first red (λ 6374A), and second red (λ 6704A) lines of the solar corona as observed during July 1947, by the High Altitude Observatory of Harvard University and the University of Colorado at Climax, Colorado, are given for every 5° measured from astronomical north positively through the east for each day on which observations were possible. An arbitrary intensity-scale of approximately 0 to 40 is used. To convert from astronomical north and to determine the positions relative to the solar rotational equator, subtract the algebraic value of the position-angle of the solar axis. This quantity varies from +26 to -26 degrees during the year, and is tabulated in the nautical almanacs. If observations are uncertain, the initials l.w. (low weight) follow the date. The time of observation in hours GCT is listed. Dashes indicate that the intensity for that position is below the observable threshold. Absence of observation made at a given position is indicated by X.

CORRECTIONS TO SUNSPOT NUMBERS APPEARING IN IRPL-R23

In IRPL-R23, "Solar Cycle Data for Correlation with Radio Propagation Phenomena," issued October 1, 1945, a number of errors greater than 0.1 units have been found in table I, "Monthly average sunspot numbers," and table II, "Twelve-month running average relative sunspot numbers." The correct values are listed below. Some of the errors in table I were carried over in the computation to table II. Table III, "Smoothed relative sunspot numbers" has been found unreliable and should not be used. Smoothed numbers may be obtained by interpolation in table II.

Errata in Table I

1833	June	1.0	1870	Feb.	114.9
1835	Apr.	61.5	1875	Dec.	9.9
1838	Feb.	84.8	1894	May	101.2
1846	Dec.	65.5	1941	May	29.5
1868	Apr.	36.6			

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1770	1771	1772	1773	1774	1775	1776
Jan.	104.0	36.0	100.9	54.6	46.8	4.4	21.7
Feb.	142.5	46.2	90.8	29.0	65.4	0.0	11.6
Mar.	80.1	46.7	31.1	51.2	55.7	11.6	6.3
Apr.	51.0	64.9	92.2	32.9	43.8	11.2	21.8
May	70.1	152.7	38.0	41.1	51.3	3.9	11.2
June	83.3	119.5	57.0	28.4	28.5	12.3	19.0
July	109.8	67.7	77.3	27.7	17.5	1.0	1.0
Aug.	126.3	58.5	56.2	12.7	6.6	7.9	24.2
Sept.	104.4	101.4	50.5	29.3	7.9	3.2	16.0
Oct.	103.6	90.0	78.6	26.3	14.0	5.6	30.0
Nov.	132.2	99.7	61.3	40.9	17.7	15.1	35.0
Dec.	102.3	95.7	64.0	43.2	12.2	7.9	40.0

	1777	1778	1779	1780	1781	1782	1783
Jan.	45.0	177.3	114.7	70.0	98.7	54.0	28.0
Feb.	36.5	109.3	165.7	98.0	74.7	37.5	38.7
Mar.	39.0	134.0	118.0	98.0	53.0	37.0	26.7
Apr.	95.5	145.0	145.0	95.0	68.3	41.0	28.3
May	80.3	238.9	140.0	107.2	104.7	54.3	23.0
June	80.7	171.6	113.7	88.0	97.7	38.0	25.2
July	95.0	153.0	143.0	86.0	73.5	37.0	32.2
Aug.	112.0	140.0	112.0	86.0	66.0	44.0	20.0
Sept.	116.2	171.7	111.0	93.7	51.0	34.0	18.0
Oct.	106.5	156.3	124.0	77.0	27.3	23.2	8.0
Nov.	146.0	150.3	114.0	60.0	67.0	31.5	15.0
Dec.	157.3	105.0	110.0	58.7	35.2	30.0	10.5

	1784	1785	1786	1787	1788	1789	1790
Jan.	13.0	6.5	37.2	134.7	138.0	114.0	103.0
Feb.	8.0	8.0	47.6	106.0	129.2	125.3	127.5
Mar.	11.0	9.0	47.7	87.4	143.3	120.0	96.3
Apr.	10.0	15.7	85.4	127.2	108.5	123.3	94.0
May	6.0	20.7	92.3	134.8	113.0	123.5	93.0
June	9.0	26.3	59.0	99.2	154.2	120.0	91.0
July	6.0	36.3	83.0	128.0	141.5	117.0	69.3
Aug.	10.0	20.0	89.7	137.2	136.0	103.0	87.0
Sept.	10.0	32.0	111.5	157.3	141.0	112.0	77.3
Oct.	8.0	47.2	112.3	157.0	142.0	89.7	84.3
Nov.	17.0	40.2	116.0	141.5	94.7	134.0	82.0
Dec.	14.0	27.3	112.7	174.0	129.5	135.5	74.0

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1791	1792	1793	1794	1795	1796	1797
Jan.	72.7	58.0	56.0	45.0	21.4	22.0	14.4
Feb.	62.0	64.0	55.0	44.0	39.9	23.8	4.2
Mar.	74.0	63.0	55.5	38.0	12.6	15.7	4.0
Apr.	77.2	75.7	53.0	28.4	18.6	31.7	4.0
May	73.7	62.0	52.3	55.7	31.0	21.0	7.3
June	64.2	61.0	51.0	41.5	17.1	6.7	11.1
July	71.0	45.8	50.0	41.0	12.9	26.9	4.3
Aug.	43.0	60.0	29.3	40.0	25.7	1.5	6.0
Sept.	66.5	59.0	24.0	11.1	13.5	18.4	5.7
Oct.	61.7	59.0	47.0	28.5	19.5	11.0	6.9
Nov.	67.0	57.0	44.0	67.4	25.0	8.4	5.8
Dec.	66.0	56.0	45.7	51.4	18.0	5.1	3.0
	1798	1799	1800	1801	1802	1803	1804
Jan.	2.0	1.6	6.9	27.0	47.8	50.0	45.3
Feb.	4.0	12.6	9.3	29.0	47.0	50.8	48.3
Mar.	12.4	21.7	13.9	30.0	40.8	29.5	48.0
Apr.	1.1	8.4	0.0	31.0	42.0	25.0	50.6
May	0.0	8.2	5.0	32.0	44.0	44.3	33.4
June	0.0	10.6	23.7	31.2	46.0	36.0	34.8
July	0.0	2.1	21.0	35.0	48.0	48.3	29.8
Aug.	3.0	0.0	19.5	38.7	50.0	34.1	43.1
Sept.	2.4	0.0	11.5	33.5	51.8	45.3	53.0
Oct.	1.5	4.6	12.3	32.6	38.5	54.3	62.3
Nov.	12.5	2.7	10.5	39.8	34.5	51.0	61.0
Dec.	9.9	8.6	40.1	48.2	50.	48.0	60.0
	1805	1806	1807	1808	1809	1810	1811
Jan.	61.0	39.0	12.0	0.0	7.2	0.0	0.0
Feb.	44.1	29.6	12.2	4.5	9.2	0.0	0.0
Mar.	51.4	32.7	9.6	0.0	0.9	0.0	0.0
Apr.	37.5	27.7	23.8	12.3	2.5	0.0	0.0
May	39.0	26.4	10.0	13.5	2.0	0.0	0.0
June	40.5	25.6	12.0	13.5	7.7	0.0	0.0
July	37.6	30.0	12.7	6.7	0.3	0.0	6.6
Aug.	42.7	26.3	12.0	8.0	0.2	0.0	0.0
Sept.	44.4	24.0	5.7	11.7	0.4	0.0	2.4
Oct.	29.4	27.0	8.0	4.7	0.0	0.0	6.1
Nov.	41.0	25.0	2.6	10.5	0.0	0.0	0.8
Dec.	38.3	24.0	0.0	12.3	0.0	0.0	1.1

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1812	1813	1814	1815	1816	1817	1818
Jan.	11.3	0.0	22.2	19.2	26.3	36.4	34.9
Feb.	1.9	10.3	12.0	32.2	68.8	57.9	22.4
Mar.	0.7	1.9	5.7	26.2	73.7	96.2	29.7
Apr.	0.0	16.6	23.8	31.6	58.8	26.4	34.5
May	1.0	5.5	5.8	9.8	44.3	21.2	53.1
June	1.3	11.2	14.9	55.9	43.6	40.0	36.4
July	0.5	18.3	18.5	35.5	38.8	50.0	28.0
Aug.	15.6	8.4	2.3	47.2	23.2	45.0	31.5
Sept.	5.2	15.3	8.1	31.5	47.8	36.7	26.1
Oct.	3.9	27.8	19.3	33.5	56.4	25.6	31.7
Nov.	7.9	16.7	14.5	37.2	38.1	28.9	10.9
Dec.	10.1	14.3	20.1	65.0	29.9	28.4	25.8

	1819	1820	1821	1822	1823	1824	1825
Jan.	32.5	19.2	21.5	0.0	0.0	21.6	5.0
Feb.	20.7	26.6	4.3	0.9	0.0	10.8	15.5
Mar.	3.7	4.5	5.7	16.1	0.6	0.0	22.4
Apr.	20.2	19.4	9.2	13.5	0.0	19.4	3.8
May	19.6	29.3	1.7	1.5	0.0	2.8	15.4
June	35.0	10.8	1.8	5.6	0.0	0.0	15.4
July	31.4	20.6	2.5	7.9	0.5	0.0	30.9
Aug.	26.1	25.9	4.8	2.1	0.0	1.4	25.4
Sept.	14.9	5.2	4.4	0.0	0.0	20.5	15.7
Oct.	27.5	9.0	18.8	0.4	0.0	25.2	15.6
Nov.	25.1	7.9	4.4	0.0	0.0	0.0	11.7
Dec.	30.6	9.7	0.0	0.0	20.4	0.8	22.0

	1826	1827	1828	1829	1830	1831	1832
Jan.	17.7	34.6	52.8	43.0	52.2	47.5	30.9
Feb.	18.2	47.4	64.4	49.4	72.1	50.1	55.5
Mar.	36.7	57.8	65.0	72.3	84.8	93.4	55.1
Apr.	24.0	46.0	61.1	95.0	107.1	54.6	26.9
May	32.4	56.3	89.1	67.5	66.3	38.1	41.3
June	37.1	56.7	98.0	73.9	65.1	33.4	26.7
July	52.5	42.9	54.3	90.8	43.9	45.2	13.9
Aug.	39.6	53.7	76.4	78.3	50.7	54.9	8.9
Sept.	18.9	49.6	50.4	52.8	62.1	37.9	8.2
Oct.	50.6	57.2	34.7	57.2	84.4	46.2	21.1
Nov.	39.5	48.2	57.0	67.6	81.2	43.5	14.3
Dec.	68.1	46.1	46.9	56.5	82.1	28.9	27.5

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1833	1834	1835	1836	1837	1838	1839
Jan.	11.3	4.9	7.5	88.6	188.0	144.9	107.6
Feb.	14.9	18.1	24.5	107.6	175.6	88.8	102.5
Mar.	11.8	3.9	19.7	98.1	134.6	140.8	77.7
Apr.	2.8	1.4	64.5	142.9	138.2	126.6	61.8
May	12.9	8.8	43.6	111.4	111.3	137.6	53.8
June	11.0	7.8	33.2	124.7	158.0	94.5	54.6
July	7.0	8.7	59.8	123.7	162.8	108.2	84.7
Aug.	5.7	4.0	59.0	107.8	134.0	78.8	131.2
Sept.	11.6	11.5	100.8	95.1	96.3	73.6	132.7
Oct.	7.5	24.8	95.2	137.4	123.7	90.8	90.8
Nov.	5.9	30.5	100.0	120.9	107.0	77.4	68.8
Dec.	9.9	34.5	77.5	206.2	129.8	79.8	63.8

	1840	1841	1842	1843	1844	1845	1846
Jan.	81.2	24.0	20.4	13.3	9.4	25.7	38.7
Feb.	87.7	29.9	22.1	3.5	14.7	43.6	51.0
Mar.	55.5	29.7	21.7	8.3	13.6	43.3	63.9
Apr.	65.9	42.6	26.9	8.8	20.8	56.9	69.2
May	69.2	67.4	24.9	21.1	12.0	47.8	59.9
June	48.5	55.7	20.5	10.5	3.7	31.1	65.1
July	60.7	30.8	12.6	9.5	21.2	30.6	46.5
Aug.	57.8	39.3	26.5	11.8	23.9	32.3	54.8
Sept.	74.0	35.1	18.5	4.2	6.9	29.6	107.1
Oct.	49.8	28.5	38.1	5.3	21.5	40.7	55.9
Nov.	54.3	19.8	40.5	19.1	10.7	39.4	60.4
Dec.	53.7	38.8	17.6	12.7	21.6	59.7	66.5

	1847	1848	1849	1850	1851	1852	1853
Jan.	62.6	159.1	156.7	78.0	75.5	68.4	41.1
Feb.	44.9	111.8	131.7	89.4	105.4	67.5	42.9
Mar.	85.7	108.9	96.5	82.6	64.6	61.2	37.7
Apr.	44.7	107.1	102.5	54.1	56.5	65.4	47.6
May	75.4	102.2	80.6	61.6	62.6	54.9	34.7
June	85.3	123.8	81.2	70.0	63.2	46.9	40.0
July	52.2	139.2	78.0	39.1	36.1	42.0	45.9
Aug.	140.6	132.5	61.3	61.6	57.4	39.7	50.4
Sept.	161.2	100.3	93.7	86.2	67.9	37.5	33.5
Oct.	180.4	132.4	71.5	71.5	62.5	67.3	42.3
Nov.	158.3	114.6	99.7	54.8	50.9	54.3	28.8
Dec.	109.6	159.9	97.0	60.0	71.4	45.4	23.4

Table I continued

Monthly Average Relative Sunspot Numbers

	1854	1855	1856	1857	1858	1859	1860
Jan.	15.4	12.3	0.5	13.7	39.0	83.7	81.5
Feb.	20.0	11.4	4.9	7.4	34.9	87.6	88.0
Mar.	20.7	17.4	0.4	5.2	57.5	90.3	98.9
Apr.	26.4	4.4	6.5	11.1	38.3	85.7	71.4
May	24.0	9.1	0.0	29.2	41.4	91.0	107.1
June	21.1	5.3	5.0	16.0	44.5	87.1	108.6
July	18.7	0.4	4.6	22.2	56.7	95.2	116.7
Aug.	15.8	3.1	5.9	16.9	55.3	106.8	100.3
Sept.	22.4	0.0	4.4	42.4	80.1	105.8	92.2
Oct.	12.7	9.7	4.5	40.6	91.2	114.6	90.1
Nov.	28.2	4.2	7.7	31.4	51.9	97.2	97.9
Dec.	21.4	3.1	7.2	37.2	66.9	81.0	95.6

	1861	1862	1863	1864	1865	1866	1867
Jan.	62.3	63.1	48.3	57.7	48.7	31.6	0.0
Feb.	77.8	64.5	56.7	47.1	39.3	38.4	0.7
Mar.	101.0	43.6	66.4	66.3	39.5	24.6	9.2
Apr.	98.5	53.7	40.6	35.8	29.4	17.6	5.1
May	56.8	64.4	53.8	40.6	34.5	12.9	2.9
June	87.8	84.4	40.8	57.8	33.6	16.5	1.5
July	78.0	73.4	32.7	54.7	26.8	9.3	5.0
Aug.	82.5	62.5	48.1	54.8	37.8	12.7	4.9
Sept.	79.9	66.6	22.0	28.5	21.6	7.3	9.8
Oct.	67.2	42.0	39.9	33.9	17.1	14.1	13.5
Nov.	53.7	50.6	37.7	57.6	24.6	9.0	9.3
Dec.	80.5	40.9	41.2	28.6	12.8	1.5	25.2

	1868	1869	1870	1871	1872	1873	1874
Jan.	15.6	60.9	77.3	88.3	79.5	86.7	60.8
Feb.	15.8	59.3	74.9	125.3	120.1	107.0	64.2
Mar.	26.5	52.7	159.4	143.2	88.4	98.3	46.4
Apr.	26.6	41.0	160.0	162.4	102.1	76.2	32.0
May	26.7	104.0	176.0	145.5	107.6	47.9	44.6
June	31.1	108.4	135.6	91.7	109.9	44.8	38.2
July	28.6	59.2	132.4	103.0	104.5	66.9	67.8
Aug.	34.4	79.6	153.8	110.0	92.9	68.2	61.3
Sept.	43.8	80.6	136.0	80.3	114.6	47.5	28.0
Oct.	61.7	59.4	146.4	89.0	103.5	47.4	34.3
Nov.	59.1	77.4	147.5	105.4	112.0	55.4	28.9
Dec.	67.6	104.3	130.0	90.3	83.9	49.2	29.3

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1875	1876	1877	1878	1879	1880	1881
Jan.	14.6	14.3	24.4	3.3	0.8	24.0	36.4
Feb.	22.2	15.0	8.7	6.0	0.6	27.5	53.2
Mar.	33.8	31.2	11.7	7.8	0.0	19.5	51.5
Apr.	29.1	2.3	15.8	0.1	6.2	19.3	51.7
May	11.5	5.1	21.2	5.8	2.4	23.5	43.5
June	23.9	1.6	13.4	6.4	4.8	34.1	60.5
July	12.5	15.2	5.9	0.1	7.5	21.9	76.9
Aug.	14.6	8.8	6.3	0.0	10.7	48.1	58.0
Sept.	2.4	9.9	16.4	5.3	6.1	66.0	53.2
Oct.	12.7	14.3	6.7	1.1	12.3	43.0	64.0
Nov.	17.7	9.9	14.5	4.1	12.9	30.7	54.8
Dec.	19.9	8.2	2.3	0.5	7.2	29.6	47.3

	1882	1883	1884	1885	1886	1887	1888
Jan.	45.0	60.6	91.5	42.8	29.9	10.3	12.7
Feb.	69.3	46.9	86.9	71.8	25.9	13.2	7.1
Mar.	67.5	42.8	86.8	49.8	57.3	4.2	7.8
Apr.	95.8	82.1	76.1	55.0	43.7	6.9	5.1
May	64.1	32.1	66.5	73.0	30.7	20.0	7.0
June	45.2	76.5	51.2	83.7	27.1	15.7	7.1
July	45.4	80.6	53.1	66.5	30.3	23.3	3.1
Aug.	40.4	46.0	55.8	50.0	16.9	21.4	2.8
Sept.	57.7	52.6	61.9	39.6	21.4	7.4	8.3
Oct.	59.2	83.8	47.8	38.7	8.6	6.6	2.1
Nov.	84.4	84.5	36.6	33.3	0.3	6.9	10.7
Dec.	41.8	75.9	47.2	21.7	12.4	20.7	6.7

	1889	1890	1891	1892	1893	1894	1895
Jan.	0.8	5.3	13.5	69.1	75.0	83.2	63.3
Feb.	3.0	3.6	22.2	75.6	73.0	84.6	67.2
Mar.	7.0	5.1	10.4	49.9	65.7	52.3	61.0
Apr.	4.3	1.6	20.5	69.6	88.1	81.6	76.9
May	2.4	4.8	41.1	79.6	84.7	10.2	67.5
June	6.4	1.3	48.3	76.3	88.2	98.9	71.5
July	9.7	11.6	58.8	76.8	88.8	106.0	47.8
Aug.	20.6	8.5	33.2	101.4	129.2	70.3	68.9
Sept.	6.5	17.2	53.8	62.8	77.9	65.9	57.7
Oct.	2.1	11.2	51.5	70.5	79.7	75.5	67.9
Nov.	0.2	9.6	41.9	65.4	75.1	56.6	47.2
Dec.	6.7	7.8	32.2	78.6	93.8	60.0	70.7

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1896	1897	1898	1899	1900	1901	1902
Jan	29.0	40.6	30.2	19.5	9.4	0.2	5.2
Feb.	57.4	29.4	36.4	9.2	13.6	2.4	0.0
Mar.	52.0	29.1	38.3	18.1	8.6	4.5	12.4
Apr.	43.8	31.0	14.5	14.2	16.0	0.0	0.0
May	27.7	20.0	25.8	7.7	15.2	10.2	2.8
June	49.0	11.3	22.3	20.5	12.1	5.8	1.4
July	45.0	27.6	9.0	13.5	8.3	0.7	0.9
Aug.	27.2	21.8	31.4	2.9	4.3	1.0	2.3
Sept.	61.3	48.1	34.8	8.4	8.3	0.6	7.6
Oct.	28.4	14.3	34.4	13.0	12.9	3.7	16.3
Nov.	38.0	8.4	30.9	7.8	4.5	3.8	10.3
Dec.	42.6	33.3	12.6	10.5	0.3	0.0	1.1

	1903	1904	1905	1906	1907	1908	1909
Jan.	8.3	31.6	54.8	45.5	76.4	39.2	56.7
Feb.	17.0	24.5	85.8	31.3	108.2	33.9	46.6
Mar.	13.5	37.2	56.5	64.5	60.7	28.7	66.3
Apr.	26.1	43.0	39.3	55.3	52.6	57.6	32.3
May	14.6	39.5	48.0	57.7	42.9	40.8	36.0
June	16.3	41.9	49.0	63.2	40.4	48.1	22.6
July	27.9	50.6	73.0	103.6	49.7	39.5	35.8
Aug.	28.8	58.2	58.8	47.7	54.3	90.5	23.1
Sept.	11.1	30.1	55.0	56.1	85.0	86.9	38.8
Oct.	38.9	54.2	78.7	17.8	65.4	32.3	58.4
Nov.	44.5	38.0	107.2	38.9	61.5	45.5	55.8
Dec.	45.6	54.6	55.5	64.7	47.3	39.5	54.2

	1910	1911	1912	1913	1914	1915	1916
Jan.	26.4	3.4	0.3	2.3	2.8	23.0	45.3
Feb.	31.5	9.0	0.0	2.9	2.6	42.3	55.4
Mar.	21.4	7.8	4.9	0 5	3.1	38.8	67.0
Apr.	8.4	16.5	4.5	0.9	17.3	41.3	71.8
May	22.2	9.0	4.4	0.0	5.2	33.0	74.5
June	12.3	2.2	4.1	0.0	11.4	68.8	67.7
July	14.1	3.5	3.0	1.7	5.4	71.6	53.5
Aug.	11.5	4.0	0.3	0.2	7.7	69.6	35.2
Sept.	26.2	4.0	9.5	1.2	12.7	49.5	45.1
Oct.	38.3	2.6	4.6	3.1	8.2	53.5	50.7
Nov.	4.9	4.2	1.1	0.7	16.4	42.5	65.6
Dec.	5.8	2.2	6.4	3.8	22.3	34.5	53.0

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1917	1918	1919	1920	1921	1922	1923
Jan.	74.7	96.0	48.1	51.1	31.5	11.8	4.5
Feb.	71.9	65.3	79.5	53.9	28.3	26.4	1.5
Mar.	94.8	72.2	66.5	70.2	26.7	54.7	3.3
Apr.	74.7	80.5	51.8	14.8	32.4	11.0	6.1
May	114.1	76.7	88.1	33.3	22.2	8.0	3.2
June	114.9	59.4	111.2	38.7	33.7	5.8	9.1
July	119.8	107.6	64.7	27.5	41.9	10.9	3.5
Aug.	154.5	101.7	69.0	19.2	22.8	6.5	0.5
Sept.	129.4	79.9	54.7	3.63	17.8	4.7	13.2
Oct.	72.2	85.0	52.8	49.6	18.2	6.2	11.6
Nov.	96.4	83.4	42.0	27.2	17.8	7.4	10.0
Dec.	129.3	59.2	34.9	29.9	20.3	17.5	2.8

	1924	1925	1926	1927	1928	1929	1930
Jan.	0.5	5.5	71.8	81.6	83.5	68.9	65.3
Feb.	5.1	23.2	70.0	93.0	73.5	64.1	49.2
Mar.	1.8	18.0	62.5	69.6	85.4	50.2	35.0
Apr.	11.3	31.7	38.5	93.5	80.6	52.8	38.2
May	20.8	42.8	64.3	79.1	76.9	58.2	36.8
June	24.0	47.5	73.5	59.1	91.4	71.9	28.8
July	28.1	38.5	52.3	54.9	98.0	70.2	21.9
Aug.	19.3	37.9	61.6	53.8	83.8	65.8	24.9
Sept.	25.1	60.2	60.8	68.4	89.7	34.4	32.1
Oct.	25.6	69.2	71.5	63.1	61.4	54.0	34.4
Nov.	22.5	58.6	60.5	67.2	50.3	81.1	35.6
Dec.	16.5	98.6	79.4	45.2	59.0	108.0	25.8

	1931	1932	1933	1934	1935	1936	1937
Jan.	14.6	12.1	12.3	3.4	18.9	62.8	132.5
Feb.	43.1	10.6	22.2	7.8	20.5	74.3	128.5
Mar.	30.0	11.2	10.1	4.3	23.1	77.1	83.9
Apr.	31.2	11.2	2.9	11.3	12.2	74.9	109.3
May	24.6	17.9	3.2	19.7	27 3	54.6	116.7
June	15.3	22.2	5.2	6.7	45.7	70.0	130.3
July	17.4	9.6	2.8	9.3	33.9	52.3	145.1
Aug.	13.0	6.8	0.2	8.3	30.1	87.0	137.7
Sept.	19.0	4.0	5.1	4.0	42.1	76.0	100.7
Oct.	10.0	8.9	3.0	5.7	53.2	89.0	124.9
Nov.	18.7	8.2	0.6	8.7	64.2	115.4	74.4
Dec.	17.8	11.0	0.3	15.4	61.5	123.4	88.8

Table I (continued)

Monthly Average Relative Sunspot Numbers

	1938	1939	1940	1941	1942	1943	1944
Jan.	98.4	80.3	50.5	45.6	35.6	12.4	3.7
Feb.	119.2	77.4	59.4	44.5	52.8	28.9	0.5
Mar.	86.5	64.6	83.3	46.4	54.2	27.4	11.0
Apr.	101.0	109.1	60.7	32.8	60.7	26.1	0.3
May	127.4	118.3	54.4	29.9	25.0	14.1	2.5
June	97.5	101.0	83.9	59.8	11.4	7.6	5.0
July	165.3	97.6	67.5	66.9	17.7	13.2	5.0
Aug.	115.7	105.8	105.5	60.0	20.2	19.4	16.7
Sept.	89.6	112.6	66.5	65.9	17.2	10.0	14.3
Oct.	99.1	88.1	55.0	46.3	19.2	7.8	16.9
Nov.	122.2	68.1	58.4	38.3	30.7	10.2	10.8
Dec.	92.7	42.1	68.3	33.7	22.5	18.8	28.4

	1945	1946	1947	1948	1949	1950	1951
Jan.	16.6						
Feb.	12.4						
Mar.	21.2						
Apr.	32.0						
May	30.7						
June	36.2						
July	43.7						
Aug.	25.6						
Sept.							
Oct.							
Nov.							
Dec.							

Table II

Twelve-Month Running Average Relative Sunspot Numbers

	1749	1750	1751	1752	1753	1754	1755
Dec.		89.4	67.6	46.6	40.5	17.2	9.6
Jan.		88.6	66.0	47.7	35.8	16.9	8.8
Feb.		91.7	62.4	45.1	36.6	14.7	8.0
Mar.		93.0	56.7	45.4	36.7	13.1	8.8
Apr.		92.2	53.2	47.4	34.9	13.0	8.8
May		84.2	50.3	48.1	33.4	12.4	8.2
June	80.9	83.4	47.6	47.8	30.7	12.2	9.6
July	82.2	83.1	44.7	48.6	27.0	13.1	9.8
Aug.	83.3	80.4	45.3	47.0	24.6	13.8	9.4
Sept.	84.9	76.8	47.4	44.9	20.9	14.2	9.3
Oct.	87.6	74.1	47.7	43.2	18.9	13.6	9.5
Nov.	88.0	71.6	47.6	41.2	17.6	11.8	10.6
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1756	1757	1758	1759	1760	1761	1762
Dec.							
	11.6	17.1	45.8	46.2	61.9	74.5	70.8
Jan.							
	11.2	18.8	47.3	46.8	63.1	76.8	65.8
Feb.							
	11.5	22.6	46.3	49.5	63.5	78.1	63.8
Mar.							
	11.0	24.9	48.2	50.7	62.2	81.4	61.2
Apr.							
	10.2	26.4	48.6	52.5	61.4	84.6	59.5
May							
	11.1	30.4	46.8	52.8	62.5	87.1	58.6
June							
	10.2	32.4	47.6	54.0	62.8	85.8	61.2
July							
	10.3	34.4	48.5	55.6	63.1	83.7	62.2
Aug.							
	11.5	37.0	47.8	56.8	65.7	82.2	58.8
Sept.							
	13.2	38.8	47.6	59.2	66.2	79.2	57.8
Oct.							
	15.0	42.4	45.5	60.1	67.3	78.3	55.6
Nov.							
	17.1	43.1	45.8	62.0	70.2	72.7	55.0
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1763	1764	1765	1766	1767	1768	1769
Dec.							
	51.5	48.8	25.4	17.4	19.8	51.8	78.4
Jan.							
	53.2	46.8	25.2	15.4	21.4	54.3	84.0
Feb.							
	49.8	47.1	25.2	13.3	24.4	56.5	88.4
Mar.							
	49.8	43.8	24.1	12.3	27.6	59.2	94.6
Apr.							
	47.8	42.2	23.0	11.6	30.9	62.0	101.3
May							
	46.4	39.3	22.0	10.9	35.0	65.0	106.1
June							
	45.1	36.4	20.9	11.4	37.8	69.8	106.1
July							
	45.4	33.4	19.9	12.7	40.0	71.5	108.6
Aug.							
	47.7	30.6	18.6	14.3	43.0	71.4	115.1
Sept.							
	48.2	29.3	19.6	14.8	43.3	72.9	116.4
Oct.							
	48.3	28.3	18.3	17.0	44.1	77.4	112.6
Nov.							
	49.3	26.2	18.8	17.3	48.1	77.0	112.3
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1770	1771	1772	1773	1774	1775	1776
Dec.	111.4	95.4	76.9	52.1	39.3	9.9	11.0
Jan.	111.5	91.9	77.7	48.0	38.4	8.6	11.0
Feb.	111.2	86.2	77.5	44.3	37.9	8.7	12.4
Mar.	107.5	86.0	73.3	42.6	36.2	8.3	13.4
Apr.	102.9	84.8	72.3	38.2	35.1	7.6	15.5
May	101.6	82.1	69.1	36.5	33.2	7.4	17.1
June	100.8	81.6	66.5	34.8	30.6	7.0	19.8
July	95.1	87.0	62.6	34.1	27.1	8.4	21.8
Aug.	87.1	90.7	57.5	37.2	21.6	9.4	23.8
Sept.	84.3	89.4	59.2	37.5	18.0	9.0	26.6
Oct.	85.5	91.7	54.2	38.4	15.2	9.9	32.7
Nov.	92.4	82.1	54.5	39.3	11.3	10.5	38.4
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1777	1778	1779	1780	1781	1782	1783
Dec.	43.6	142.4	139.4	105.8	79.9	48.5	30.8
Jan.	51.4	147.2	138.6	101.1	78.8	45.4	30.4
Feb.	58.8	149.6	136.3	98.9	77.2	43.6	28.4
Mar.	67.1	154.2	131.2	97.5	73.6	42.2	27.1
Apr.	73.5	158.4	128.5	93.6	69.5	41.8	25.8
May	82.7	158.7	125.5	89.1	70.0	38.9	24.4
June	92.5	154.4	125.9	84.8	68.1	38.4	22.8
July	103.5	149.2	122.2	87.2	64.4	36.3	21.6
Aug.	109.6	153.8	116.6	85.2	61.3	36.4	19.0
Sept.	117.5	152.5	114.9	81.5	59.9	35.5	17.7
Oct.	121.6	152.5	110.7	79.3	57.6	34.5	16.2
Nov.	134.8	144.3	108.0	79.1	53.4	31.9	14.7
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1784	1785	1786	1787	1788	1789	1790
Dec.	13.4	12.6	47.7	109.5	140.1	125.9	108.0
Jan.	11.2	15.1	51.6	113.3	141.2	123.8	104.0
Feb.	10.4	16.0	57.4	117.2	141.1	121.1	102.7
Mar.	9.7	17.8	64.0	121.1	139.8	118.7	99.8
Apr.	9.7	21.0	69.4	124.8	138.5	114.3	99.4
May	9.9	23.0	75.8	126.9	134.6	117.6	95.0
June	10.2	24.1	82.9	132.0	130.9	118.1	89.9
July	9.6	26.6	91.0	132.3	128.9	117.2	87.4
Aug.	9.6	30.0	95.8	134.2	128.6	117.4	81.9
Sept.	9.4	33.2	99.2	138.9	126.6	115.4	80.0
Oct.	9.9	39.0	102.6	137.3	127.9	113.0	78.6
Nov.	11.2	45.0	106.2	135.5	128.8	110.4	77.0
Dec.							

Table II (continued)

Twelve-Month Running Averages [illegible]

	1791	1792	1793	1794	1795	1796	1797
Dec.	74.8	63.2	[illegible]	[illegible]	31.7	19.6	9.7
Jan.	75.0	61.1	[illegible]	[illegible]	29.3	20.3	7.8
Feb.	71.3	62.6	[illegible]	[illegible]	28.1	18.8	8.2
Mar.	70.4	61.9	[illegible]	[illegible]	[illegible]	19.2	7.1
Apr.	68.5	61.7	[illegible]	[illegible]	27.6	[illegible]	[illegible]
May	67.2	60.9	47.8	[illegible]	24.0	17.1	[illegible]
June	66.6	60.0	46.9	41.0	21.3	16.0	6.4
July	65.4	59.9	[illegible]	39.0	21.3	15.4	5.4
Aug.	65.5	[illegible]	[illegible]	[illegible]	20.0	13.8	5.3
Sept.	64.6	[illegible]	[illegible]	[illegible]	20.2	12.8	6.0
Oct.	[illegible]	56.6	41.6	35.8	21.3	10.5	5.8
Nov.	63.5	55.5	41.8	33.7	20.5	9.3	...
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1798	1799	1800	1801	1802	1803	1804
Dec.							
	4.3	7.7	6.4	24.6	41.3	42.4	45.1
Jan.							
	3.9	7.9	8.0	25.8	42.4	42.4	43.6
Feb.							
	3.6	7.6	9.6	27.4	43.3	41.1	44.3
Mar.							
	3.4	7.4	10.6	29.2	44.8	40.5	45.0
Apr.							
	2.9	7.7	11.2	30.9	45.3	41.8	45.6
May							
	3.5	6.9	11.8	33.3	44.9	43.2	46.5
June							
	4.1	6.8	14.5	34.0	45.0	43.0	47.5
July							
	4.0	7.2	16.2	35.7	45.2	42.6	48.8
Aug.							
	4.8	6.9	17.8	37.2	45.5	42.4	48.4
Sept.							
	5.5	6.3	19.1	38.1	44.6	44.0	48.7
Oct.							
	6.1	5.6	21.7	39.0	43.2	46.1	47.6
Nov.							
	6.8	5.3	24.0	40.0	43.2	45.2	48.1
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1805	1806	1807	1808	1809	1810	1811
Dec.	48.6	34.5	19.6	7.1	7.0	0.1	0.0
Jan.	49.2	33.9	18.2	6.6	6.4	0.0	0.6
Feb.	49.2	32.5	17.0	6.2	5.8	0.0	0.6
Mar.	48.4	30.8	15.5	6.7	4.8	0.0	0.8
Apr.	45.7	30.6	13.9	6.4	4.4	0.0	1.2
May	44.0	29.3	12.0	7.1	3.6	0.0	1.3
June	42.2	28.1	10.0	8.1	2.5	0.0	1.4
July	40.4	25.8	9.0	8.7	1.9	0.0	2.4
Aug.	39.2	24.4	8.4	9.1	1.2	0.0	2.5
Sept.	37.6	22.5	7.6	9.2	1.1	0.0	2.6
Oct.	36.8	22.2	6.6	8.4	0.9	0.0	2.6
Nov.	35.8	20.8	6.9	7.4	0.7	0.0	2.6
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1812	1813	1814	1815	1816	1817	1818
Dec.	2.8	7.4	15.4	31.5	47.1	42.7	35.5
Jan.	2.2	8.9	15.4	32.9	47.4	43.6	33.6
Feb.	3.6	8.3	14.9	28.6	45.4	45.4	32.5
Mar.	3.8	9.1	14.3	28.6	46.8	44.5	31.6
Apr.	3.6	11.1	13.6	29.8	48.6	42.0	32.1
May	4.2	11.8	13.4	31.6	48.7	41.2	30.6
June	5.0	12.2	13.9	35.4	45.8	41.0	30.4
July	4.0	14.0	13.7	36.0	46.6	40.9	30.2
Aug.	4.7	14.2	15.4	39.0	45.7	38.0	30.1
Sept.	4.8	14.5	17.1	43.0	47.6	32.4	27.9
Oct.	6.2	15.1	17.7	45.3	44.9	33.1	26.7
Nov.	6.6	15.1	18.0	48.1	43.0	35.8	23.9
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1819	1820	1821	1822	1823	1824	1825
Dec.							
	23.8	22.1	10.2	6.0	0.9	6.3	10.4
Jan.							
	24.1	21.2	8.7	6.5	0.3	6.2	13.0
Feb.							
	23.6	21.2	6.9	6.3	0.1	6.4	15.0
Mar.							
	22.7	20.4	6.9	5.9	0.1	8.1	14.6
Apr.							
	22.4	18.8	7.7	4.4	0.1	10.2	13.8
May							
	23.5	17.4	7.4	4.0	0.1	10.2	14.8
June							
	23.9	15.7	6.6	4.0	1.8	8.5	16.6
July							
	22.8	15.9	4.8	4.0	3.6	7.2	17.6
Aug.							
	23.3	14.0	4.5	3.9	4.5	7.6	17.8
Sept.							
	23.4	14.1	5.4	2.6	4.4	9.4	19.0
Oct.							
	23.3	13.2	5.7	1.5	6.0	8.1	20.7
Nov.							
	24.1	11.0	5.7	1.4	6.3	9.2	22.1
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1826	1827	1828	1829	1830	1831	1832
Dec.							
	24.0	47.3	60.7	60.1	70.9	60.1	41.1
Jan.							
	25.8	46.5	61.6	63.1	67.0	60.2	38.5
Feb.							
	26.9	47.7	63.5	63.3	64.7	60.6	34.6
Mar.							
	27.2	50.3	63.6	63.5	65.4	58.6	32.2
Apr.							
	30.1	50.8	61.7	65.3	67.7	55.4	30.1
May							
	32.4	51.5	62.4	66.2	68.8	52.2	27.6
June							
	36.3	49.7	62.5	67.0	71.0	47.8	27.5
July							
	37.7	51.2	61.7	67.8	70.6	46.4	25.9
Aug.							
	40.1	52.6	60.4	69.7	68.8	46.9	22.5
Sept.							
	41.9	53.2	61.0	70.7	69.5	43.7	18.9
Oct.							
	43.7	54.5	63.9	71.7	65.1	41.4	16.9
Nov.							
	45.7	57.2	62.1	71.6	62.8	41.6	14.5
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1833	1834	1835	1836	1837	1838	1839
Dec.	13.2	7.7	25.6	97.1	140.8	123.9	80.6
Jan.	12.6	7.8	29.8	101.9	144.6	119.4	78.6
Feb.	12.4	7.7	34.4	105.9	146.8	114.8	83.0
Mar.	12.6	7.7	41.9	105.5	146.9	112.8	87.9
Apr.	11.5	9.1	47.7	109.0	145.8	110.1	87.9
May	10.8	11.2	53.5	110.7	144.6	107.6	87.2
June	9.4	13.2	57.1	121.4	138.3	103.5	85.8
July	8.8	13.4	63.9	129.7	134.7	100.4	83.6
Aug.	9.1	14.0	70.8	135.4	127.4	101.5	82.4
Sept.	8.4	15.3	77.3	138.4	128.0	96.2	80.6
Oct.	8.3	20.6	83.8	138.0	127.0	90.8	80.9
Nov.	8.0	23.5	89.5	138.0	129.2	83.9	82.2
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1840	1841	1842	1843	1844	1845	1846
Dec.	81.7	50.0	27.4	18.3	11.4	29.5	48.3
Jan.	79.7	47.5	25.9	18.0	12.4	30.3	49.7
Feb.	73.6	45.9	24.8	16.8	13.4	31.0	51.5
Mar.	68.6	42.7	23.4	15.6	13.6	32.9	58.0
Apr.	65.2	40.9	24.2	12.9	15.0	34.5	59.3
May	64.0	38.0	26.0	11.1	14.2	36.9	61.0
June	63.2	36.8	24.2	10.7	15.0	40.0	61.6
July	58.4	36.5	23.6	10.4	16.4	41.1	63.6
Aug.	53.6	35.8	22.0	11.3	18.8	41.8	63.1
Sept.	51.4	35.2	20.9	11.7	21.2	43.5	64.9
Oct.	49.5	33.9	19.4	12.7	24.2	44.5	62.8
Nov.	49.4	30.3	19.1	12.0	27.2	45.5	64.1
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1847	1848	1849	1850	1851	1852	1853
Dec.							
	65.8	124.6	119.0	77.2	66.7	59.2	44.2
Jan.							
	66.3	131.9	113.9	74.0	66.4	59.7	44.5
Feb.							
	73.4	131.2	108.0	74.0	66.1	58.2	45.4
Mar.							
	78.0	126.2	107.4	73.4	64.6	55.7	45.1
Apr.							
	88.3	122.2	102.4	73.4	63.9	56.1	43.0
May							
	94.9	120.1	101.1	69.6	63.6	56.4	40.8
June							
	98.4	124.3	95.9	66.5	64.5	54.2	39.0
July							
	106.5	124.1	89.3	66.3	63.9	51.9	36.9
Aug.							
	112.1	125.8	85.8	67.6	60.8	49.9	35.0
Sept.							
	114.0	124.7	84.6	66.2	60.5	47.9	33.6
Oct.							
	119.2	124.4	79.8	67.2	61.2	46.4	31.8
Nov.							
	121.4	122.6	78.2	67.3	60.6	44.8	30.9
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1854	1855	1856	1857	1858	1859	1860
Dec.	29.3	14.9	3.2	9.7	37.2	77.3	96.3
Jan.	27.0	13.4	3.5	11.2	40.1	80.5	98.1
Feb.	24.2	12.3	3.7	12.1	43.3	84.8	97.6
Mar.	23.2	10.5	4.1	15.3	46.4	86.9	96.4
Apr.	20.8	10.2	3.7	18.3	50.6	88.9	94.4
May	20.7	8.2	4.0	20.3	52.3	92.6	94.5
June	20.6	6.7	4.3	22.8	54.8	93.8	95.7
July	20.3	5.7	5.4	24.9	58.5	93.6	94.1
Aug.	19.6	5.2	5.6	27.2	62.9	93.7	93.2
Sept.	19.3	3.8	6.0	31.5	65.6	94.4	93.4
Oct.	17.5	3.9	6.4	33.8	69.6	93.2	95.7
Nov.	16.2	3.2	8.8	34.8	73.7	94.6	91.5
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1861	1862	1863	1864	1865	1866	1867
Dec.	89.8	68.0	53.6	43.9	40.2	23.5	6.1
Jan.	86.5	67.6	50.2	45.7	37.9	22.1	5.8
Feb.	85.0	65.9	49.0	46.3	36.5	20.0	5.1
Mar.	84.0	64.8	45.2	46.8	35.9	18.8	5.3
Apr.	82.1	62.7	45.1	46.3	34.5	18.5	5.2
May	78.4	62.4	44.0	48.0	31.8	17.2	5.3
June	77.2	59.1	44.0	47.0	30.5	16.3	7.2
July	77.2	57.9	44.8	46.2	29.0	13.6	8.6
Aug.	76.1	57.2	44.0	45.6	29.0	10.5	9.8
Sept.	71.3	59.2	44.0	43.3	27.7	9.2	11.2
Oct.	67.6	58.1	43.6	42.8	26.8	8.2	13.0
Nov.	68.2	57.2	42.5	42.3	25.0	7.4	15.0
Dec.							

Twelve-Month Running [illegible] Sunspot Numbers

	1868	1869	1870	[illegible]	[illegible]	1873	1874
Dec.	17.5	60.1	103.6	[illegible]	[illegible]	89.4	51.7
Jan.	19.5	62.7	109.7	[illegible]	[illegible]	86.2	51.8
Feb.	21.9	66.4	115.9	[illegible]	97.5	84.2	51.2
Mar.	24.8	69.5	120.5	[illegible]	100.4	78.6	49.6
Apr.	28.8	69.3	127.8	[illegible]	[illegible]	73.9	48.5
May	32.9	70.8	133.6	[illegible]	102.1	69.2	46.3
June	36.4	73.9	135.8	[illegible]	101.6	66.3	44.6
July	40.2	75.3	136.7	[illegible]	[illegible]	64.1	40.8
Aug.	43.8	76.6	140.9	[illegible]	[illegible]	60.6	37.3
Sept.	46.0	85.4	139.6	[illegible]	[illegible]	56.2	36.2
Oct.	47.2	95.4	139.7	[illegible]	99.8	52.6	36.0
Nov.	53.7	101.4	137.8	[illegible]	[illegible]	52.3	33.2
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1875	1876	1877	1878	1879	1880	1881
Dec.							
	32.0	12.4	13.4	6.8	2.2	17.0	44.7
Jan.							
	27.4	12.7	12.7	6.3	2.8	18.2	49.2
Feb.							
	23.6	12.2	12.5	5.8	3.7	21.4	50.1
Mar.							
	21.4	12.8	13.0	4.8	3,7	26.4	49.0
Apr.							
	19.6	12.9	12.4	4.4	4.7	28.9	50.8
May							
	18.7	12.3	12.8	3.5	5.4	30.4	52.8
June							
	17.9	11.3	12.3	3.4	6.0	32.3	54.2
July							
	17.9	12.2	10.5	3.2	7.9	33.3	55.0
Aug.							
	17.3	11.6	10.3	2.7	10.1	35.4	56.3
Sept.							
	17.1	10.0	10.0	2.1	11.8	38.1	57.6
Oct.							
	14.8	11.1	8.6	2.6	12.8	40.8	61.3
Nov.							
	14.3	12.5	7.4	2.3	14.6	42.5	63.0
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1882	1883	1884	1885	1886	1887	1888
Dec.	61.8	55.8	73.5	56.5	38.7	13.4	11.1
Jan.	59.1	58.8	71.2	57.6	35.7	12.8	9.4
Feb.	57.7	59.2	72.0	57.2	32.9	13.1	7.8
Mar.	58.0	58.8	72.8	55.3	31.4	12.0	8.0
Apr.	57.6	60.8	69.8	54.6	28.9	11.8	7.6
May	60.1	60.8	65.8	54.3	26.2	12.4	7.9
June	59.6	63.7	63.4	52.2	25.4	13.0	6.8
July	61.0	66.3	59.4	51.1	23.7	13.2	5.8
Aug.	59.1	69.6	58.1	47.2	22.7	12.7	5.9
Sept.	57.0	73.3	55.0	47.9	18.2	13.0	5.8
Oct.	55.9	72.8	53.3	46.9	15.2	12.9	5.7
Nov.	53.2	75.6	53.8	43.4	14.3	11.8	5.4
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1889	1890	1891	1892	1893	1894	1895
Dec.	5.3	5.4	18.5	57.6	77.5	79.6	70.1
Jan.	5.8	5.5	22.4	58.1	78.5	81.0	65.3
Feb.	7.3	4.5	24.5	64.8	80.8	76.1	65.2
Mar.	7.1	5.4	27.5	65.6	82.1	75.1	64.5
Apr.	7.1	6.2	30.9	67.1	82.8	74.8	63.8
May	6.3	7.0	33.6	69.1	83.7	73.2	63.1
June	6.3	7.0	35.6	73.0	84.9	70.4	64.0
July	6.6	7.7	40.2	73.4	85.6	68.8	61.1
Aug.	6.0	9.5	44.7	73.2	86.6	67.3	60.3
Sept.	5.8	10.0	48.0	74.6	85.5	68.0	59.5
Oct.	5.6	11.6	52.1	76.1	84.9	67.6	56.8
Nov.	5.8	14.6	55.3	76.5	78.7	72.4	53.5
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1896	1897	1898	1899	1900	1901	1902
Dec.	51.6	33.6	26.8	20.2	10.9	5.1	2.6
Jan.	51.4	32.2	25.2	20.6	10.5	4.5	2.6
Feb.	47.9	31.8	26.0	18.2	10.6	4.2	2.8
Mar.	48.2	30.6	24.9	16.0	10.6	3.6	3.3
Apr.	44.9	29.5	26.6	14.2	10.6	2.8	4.4
May	44.1	27.0	28.4	12.3	10.3	2.8	4.9
June	41.8	26.2	26.7	12.1	9.4	2.7	5.0
July	42.8	25.4	25.8	11.3	8.7	3.2	5.3
Aug.	40.4	26.0	23.6	11.6	7.8	3.0	6.7
Sept.	38.5	26.7	21.9	10.8	7.4	3.6	6.8
Oct.	37.4	25.4	21.8	11.0	6.1	3.6	9.0
Nov.	36.8	25.8	20.3	11.6	5.7	3.0	10.0
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1903	1904	1905	1906	1907	1908	1909
Dec.	11.2	34.5	51.6	62.1	59.2	51.0	49.6
Jan.	13.4	36.4	53.4	64.7	54.7	50.1	49.2
Feb.	15.6	38.9	53.5	63.8	55.2	53.1	43.6
Mar.	15.9	40.5	55.6	63.8	57.6	53.3	39.6
Apr.	17.8	41.7	57.6	58.8	61.6	50.5	41.8
May	20.7	41.2	63.4	53.1	63.5	49.2	42.6
June	24.4	42.0	63.5	53.8	62.0	48.5	43.9
July	26.3	43.9	62.7	56.4	58.9	50.0	41.4
Aug.	26.9	49.0	58.2	62.8	52.7	51.0	40.1
Sept.	28.9	50.6	58.8	62.5	50.1	54.2	36.4
Oct.	30.3	50.3	60.2	62.3	50.5	52.1	34.4
Nov.	32.4	51.0	61.0	61.1	50.3	51.7	33.2
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1910	1911	1912	1913	1914	1915	1916
Dec.	32.4	12.4	3.2	2.6	4.4	26.6	58.6
Jan.	30.6	11.5	3.2	2.5	4.7	32.2	57.1
Feb.	29.6	10.9	2.9	2.5	5.4	37.3	54.2
Mar.	28.5	9.0	3.3	1.8	6.3	40.4	53.8
Apr.	26.8	6.1	3.5	1.7	6.7	44.2	53.6
May	22.6	6.0	3.2	1.6	8.0	46.4	55.5
June	18.6	5.7	3.6	1.4	9.6	47.4	57.1
July	16.7	5.4	3.9	1.5	11.3	49.2	59.5
Aug.	14.8	4.7	4.0	1.4	14.6	50.3	60.9
Sept.	13.6	4.4	3.6	1.7	17.6	52.7	63.2
Oct.	14.3	3.4	3.3	3.0	19.6	55.2	63.4
Nov.	13.2	3.1	3.0	3.5	21.9	58.7	66.8
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1917	1918	1919	1920	1921	1922	1923
Dec.							
	70.7	96.0	80.2	48.3	30.4	21.4	6.7
Jan.							
	76.2	95.0	76.6	45.2	31.6	18.8	6.1
Feb.							
	86.2	90.6	73.9	41.1	31.9	17.4	5.6
Mar.							
	93.2	86.4	71.8	39.6	30.3	16.3	6.3
Apr.							
	95.0	87.5	69.1	39.3	27.7	15.3	6.8
May							
	97.5	86.4	65.6	38.0	26.9	14.5	7.0
June							
	103.9	80.6	63.6	37.6	26.1	14.2	5.8
July							
	105.7	76.6	63.8	36.0	24.5	13.6	5.4
Aug.							
	105.1	77.8	61.7	33.9	24.3	11.6	5.7
Sept.							
	103.2	77.3	62.0	30.2	26.7	7.3	5.6
Oct.							
	103.7	74.9	59.0	31.7	24.9	6.9	6.0
Nov.							
	100.6	75.8	54.4	30.8	23.7	6.5	7.5
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1924	1925	1926	1927	1928	1929	1930
Dec.							
	8.8	25.5	62.0	71.8	70.3	67.4	55.6
Jan.							
	10.8	26.4	63.1	72.0	73.9	65.0	51.5
Feb.							
	12.4	27.9	65.1	71.4	76.4	63.5	48.1
Mar.							
	13.4	30.8	65.1	72.0	78.2	58.9	47.9
Apr.							
	14.5	34.4	65.3	71.3	78.0	58.3	46.3
May							
	15.6	37.5	65.5	71.9	76.6	60.9	42.5
June							
	16.7	44.3	63.9	69.0	77.8	65.0	35.7
July							
	17.1	49.8	64.7	69.2	76.6	64.7	31.4
Aug.							
	18.6	53.7	66.6	67.6	75.8	63.4	30.9
Sept.							
	20.0	57.4	67.2	68.9	72.8	62.2	30.5
Oct.							
	21.7	58.0	71.8	67.8	70.5	60.9	29.9
Nov.							
	23.5	59.8	73.0	67.6	69.0	59.2	28.9
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1931	1932	1933	1934	1935	1936	1937
Dec.	27.8	15.1	8.7	5.4	16.6	58.2	103.7
Jan.	27.4	14.4	8.1	6.0	18.6	59.8	111.4
Feb.	26.4	13.9	7.6	6.6	20.4	64.5	115.6
Mar.	25.3	12.7	7.7	6.6	23.6	67.3	117.7
Apr.	23.3	12.6	7.2	6.8	27.6	70.3	120.7
May	21.9	11.7	6.6	7.4	32.2	74.6	117.3
June	21.2	11.1	5.6	8.7	36.0	79.7	114.4
July	21.0	11.2	4.9	10.0	39.7	85.5	111.6
Aug.	18.3	12.1	3.7	11.1	44.2	90.0	110.8
Sept..	16.7	12.0	3.2	12.6	48.7	90.6	111.0
Oct.	15.1	11.3	3.9	12.7	53.9	93.5	110.3
Nov.	14.5	10.1	5.3	13.3	56.2	98.7	111.2
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1938	1939	1940	1941	1942	1943	1944
Dec.	108.5	102.9	75.5	56.7	45.9	20.3	8.5
Jan.	110.2	97.3	73.0	56.6	41.8	20.0	7.8
Feb.	108.3	96.5	73.0	52.8	38.5	19.9	7.6
Mar.	107.4	98.4	69.2	52.8	34.4	19.3	8.0
Apr.	105.2	97.5	66.4	52.1	32.2	18.3	8.7
May	109.2	93.0	65.6	50.4	31.5	16.6	8.8
June	109.6	88.8	67.8	47.5	30.6	16.3	9.6
July	108.0	86.3	67.4	46.7	28.7	15.6	10.7
Aug.	104.6	84.8	66.1	47.4	26.7	13.2	11.6
Sept.	102.7	86.3	63.0	48.0	24.4	11.9	12.5
Oct.	103.4	82.3	60.7	50.3	21.6	9.7	15.2
Nov.	102.6	77.0	58.7	49.9	20.6	8.8	17.5
Dec.							

Table II (continued)

Twelve-Month Running Average Relative Sunspot Numbers

	1945	1946	1947	1948	1949	1950	1951
Dec.							
	20.1						
Jan.							
	23.3						
Feb.							
	24.1						
Mar.							
Apr.							
May							
June							
July							
Aug.							
Sept.							
Oct.							
Nov.							
Dec.							

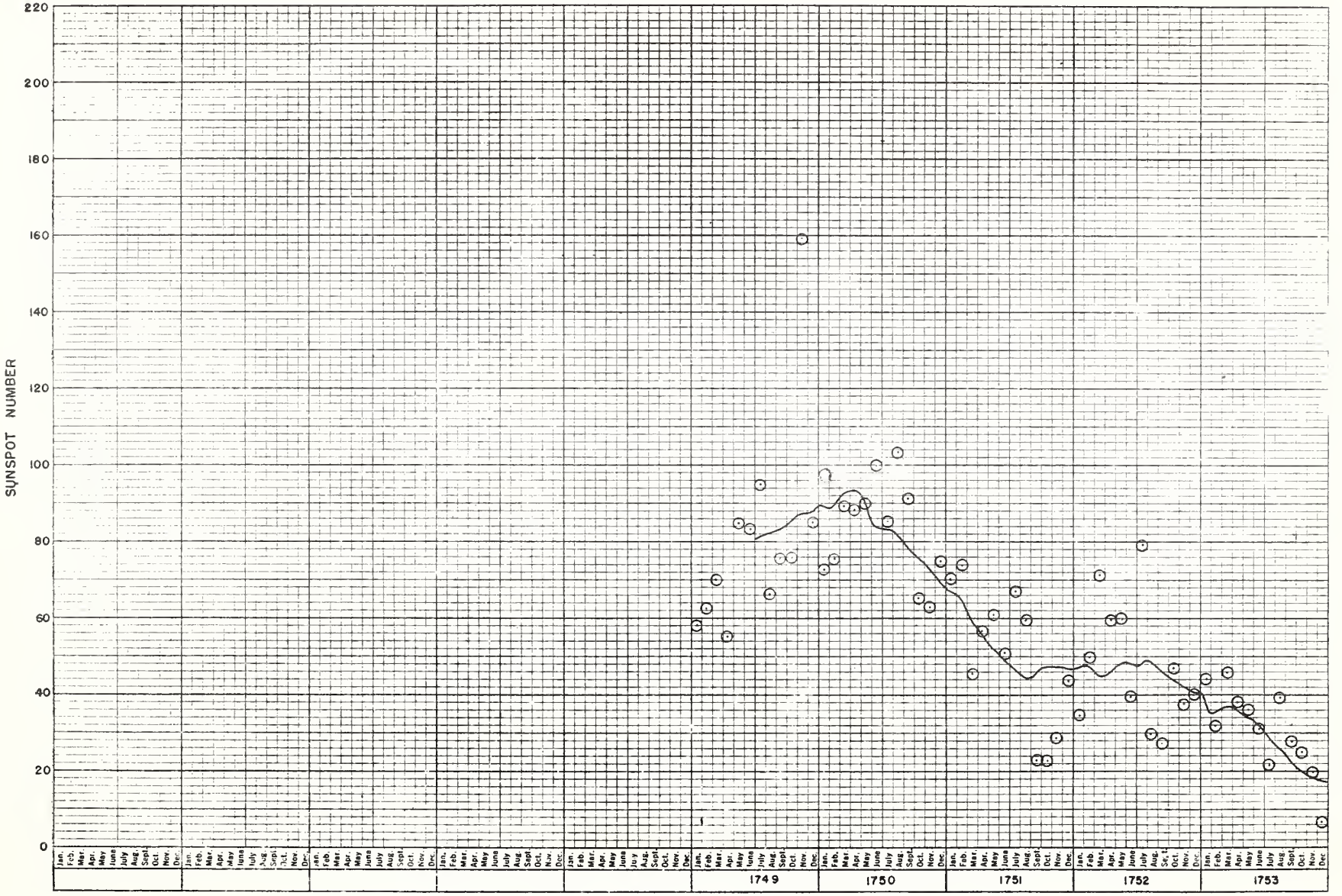
Table III

Smoothed Relative Sunspot Numbers

(Averages of Consecutive Pairs of Twelve-Month Running-Average Sunspot Numbers)

	1933	1934	1935	1936	1937	1938	1939
Jan.	8.4	5.8	17.5	59.5	108.0	109.5	100.0
Feb.	7.8	6.5	19.7	62.0	114.0	109.2	97.0
Mar.	7.6	7.0	22.0	65.5	117.0	108.1	97.0
Apr.	7.4	6.8	25.8	69.0	120.4	106.3	98.3
May	6.9	7.0	30.0	72.2	120.2	107.0	95.0
June	6.1	8.0	35.0	77.0	117.0	109.5	90.2
July	5.2	9.5	38.0	82.0	112.8	109.0	87.5
Aug.	4.3	10.8	43.0	88.0	111.0	107.0	85.5
Sept.	3.4	11.8	47.0	90.5	111.0	103.0	85.0
Oct.	3.6	13.0	52.0	91.8	110.5	103.0	85.0
Nov.	4.6	13.0	55.7	95.5	110.8	103.2	79.0
Dec.	5.4	15.0	57.8	101.5	110.0	103.0	76.2

	1940	1941	1942	1943	1944	1945	1946
Jan.	74.0	57.0	43.9	20.2	8.2	21.7	
Feb.	73.0	55.5	40.2	20.0	7.7	23.7	
Mar.	71.0	52.6	36.5	19.6	7.8		
Apr.	68.0	52.3	33.3	18.8	8.4		
May	65.8	51.0	31.9	17.4	8.8		
June	66.5	48.0	31.1	16.4	9.2		
July	67.5	47.1	29.7	16.0	10.2		
Aug.	66.6	47.1	28.2	14.4	11.2		
Sept.	64.3	47.7	25.6	12.6	12.0		
Oct.	61.8	49.2	23.0	10.8	13.8		
Nov.	59.5	50.1	21.1	9.2	16.4		
Dec.	57.5	47.6	20.5	8.6	18.8		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180
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140
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100
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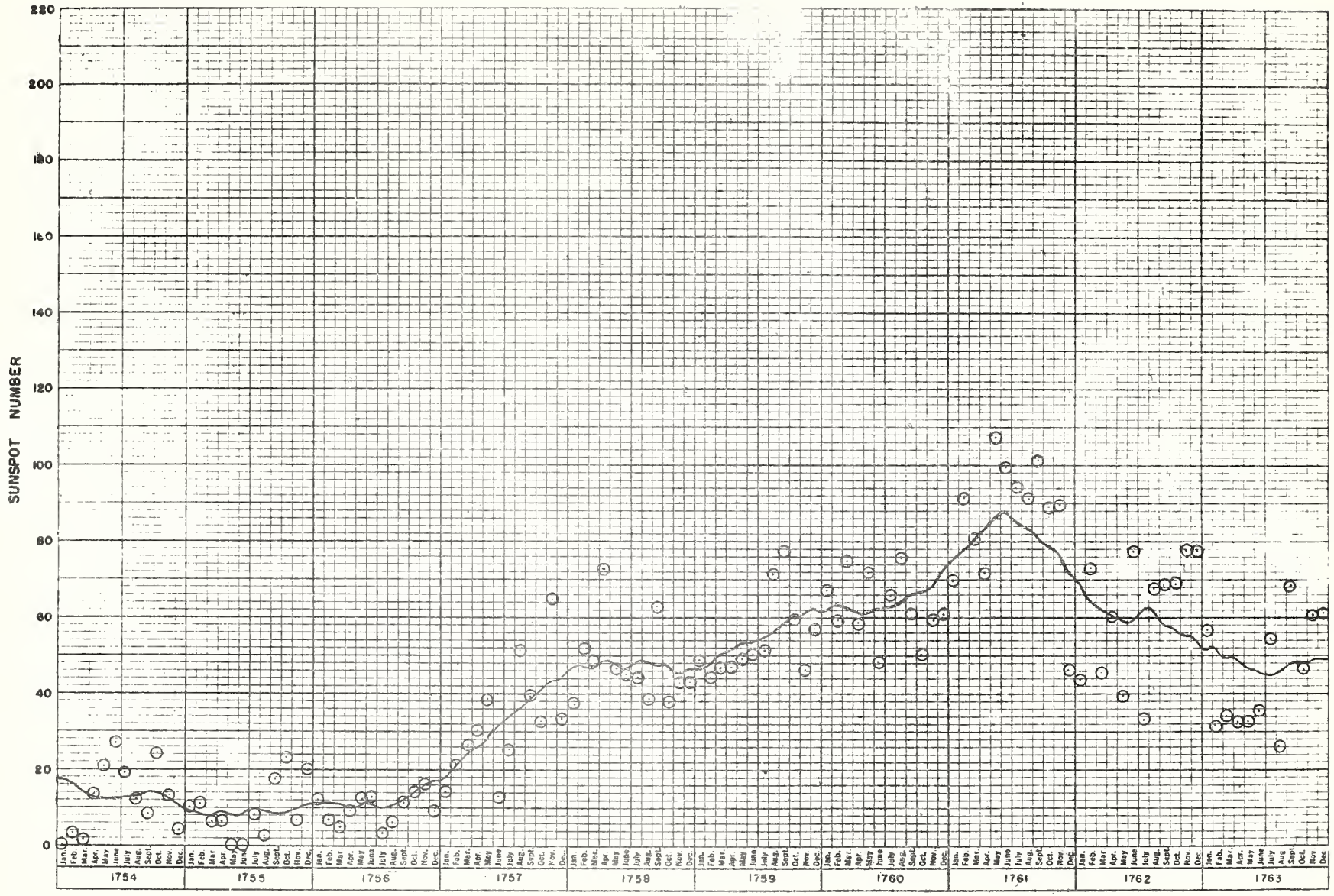
60
40
20
0
1749
1750
1751
1752
1753

FIG. 1.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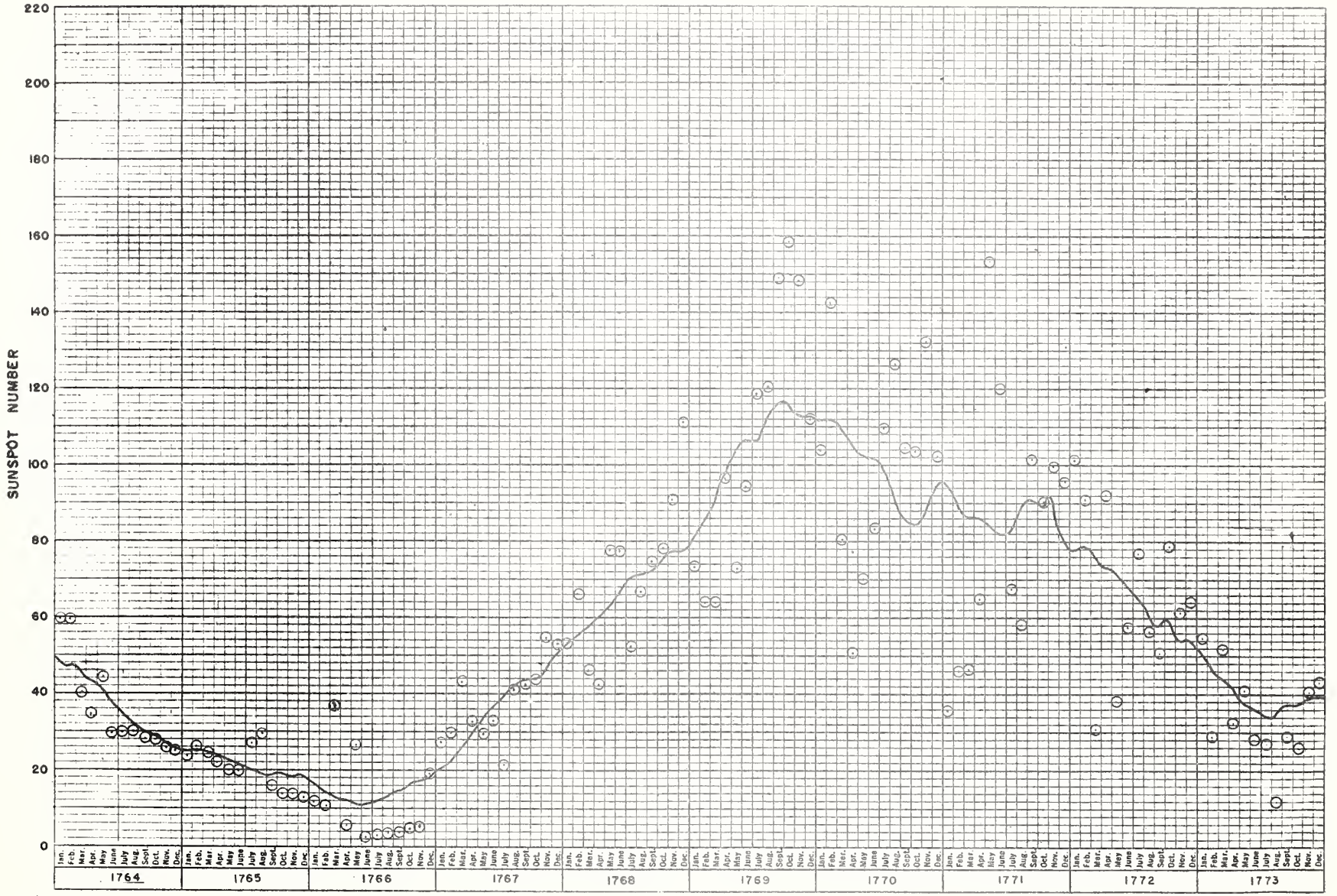
1760
1761
1762
1763

FIG. 2.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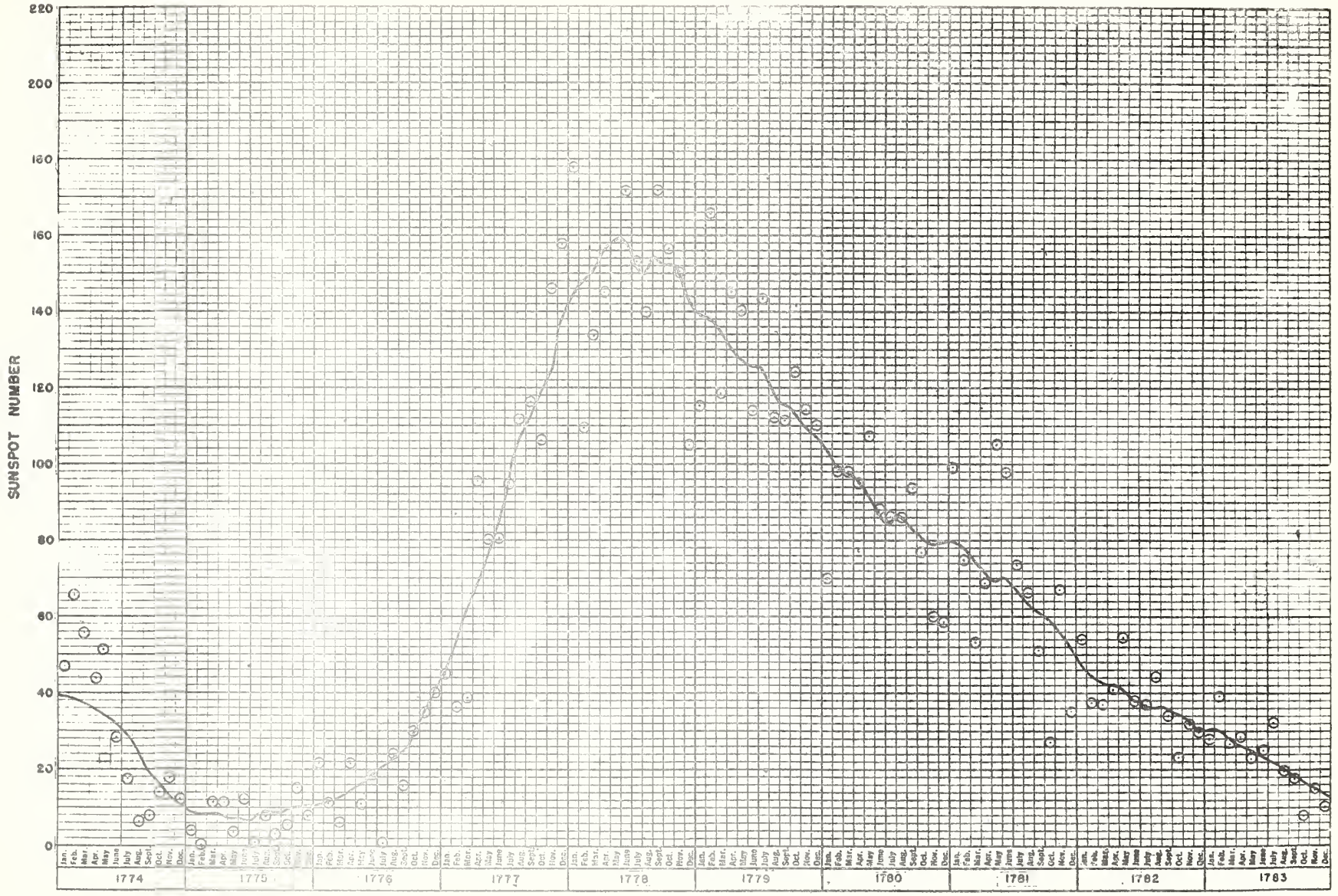
1769
1770
1771
1772
1773

FIG. 3.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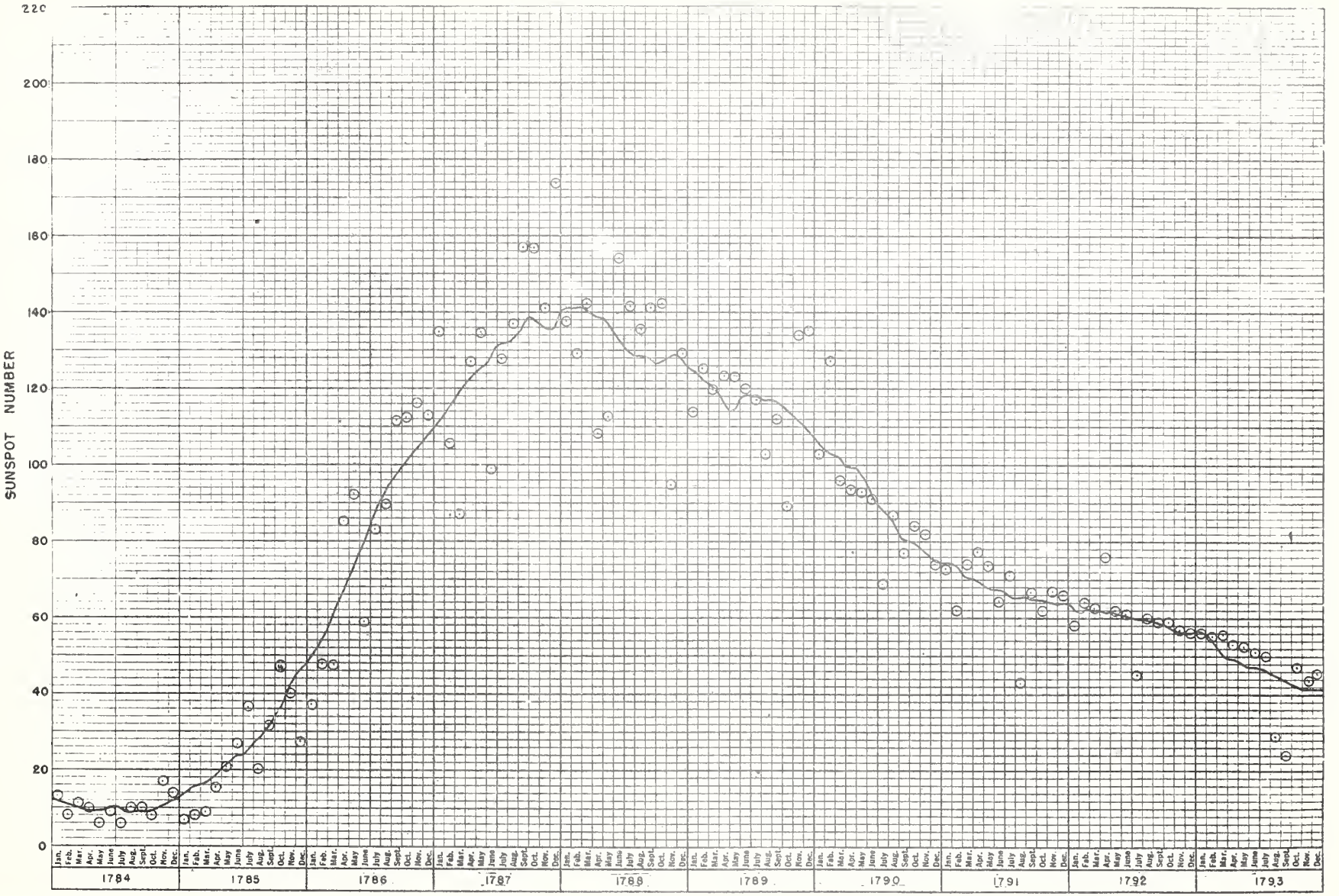
1778
1779
1780
1781
1782
1783

FIG. 4.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1789
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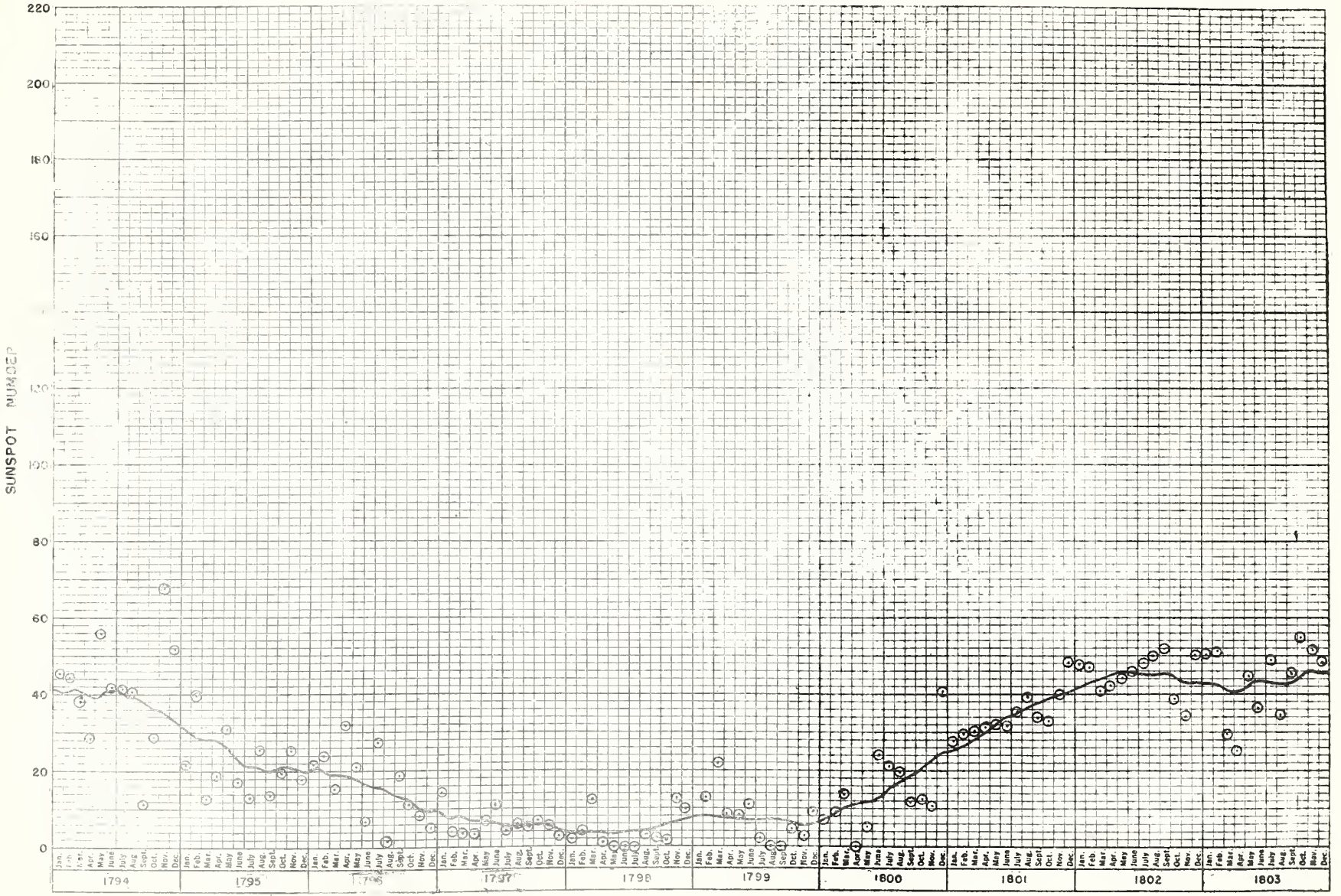
1791
1792
1793

FIG.5.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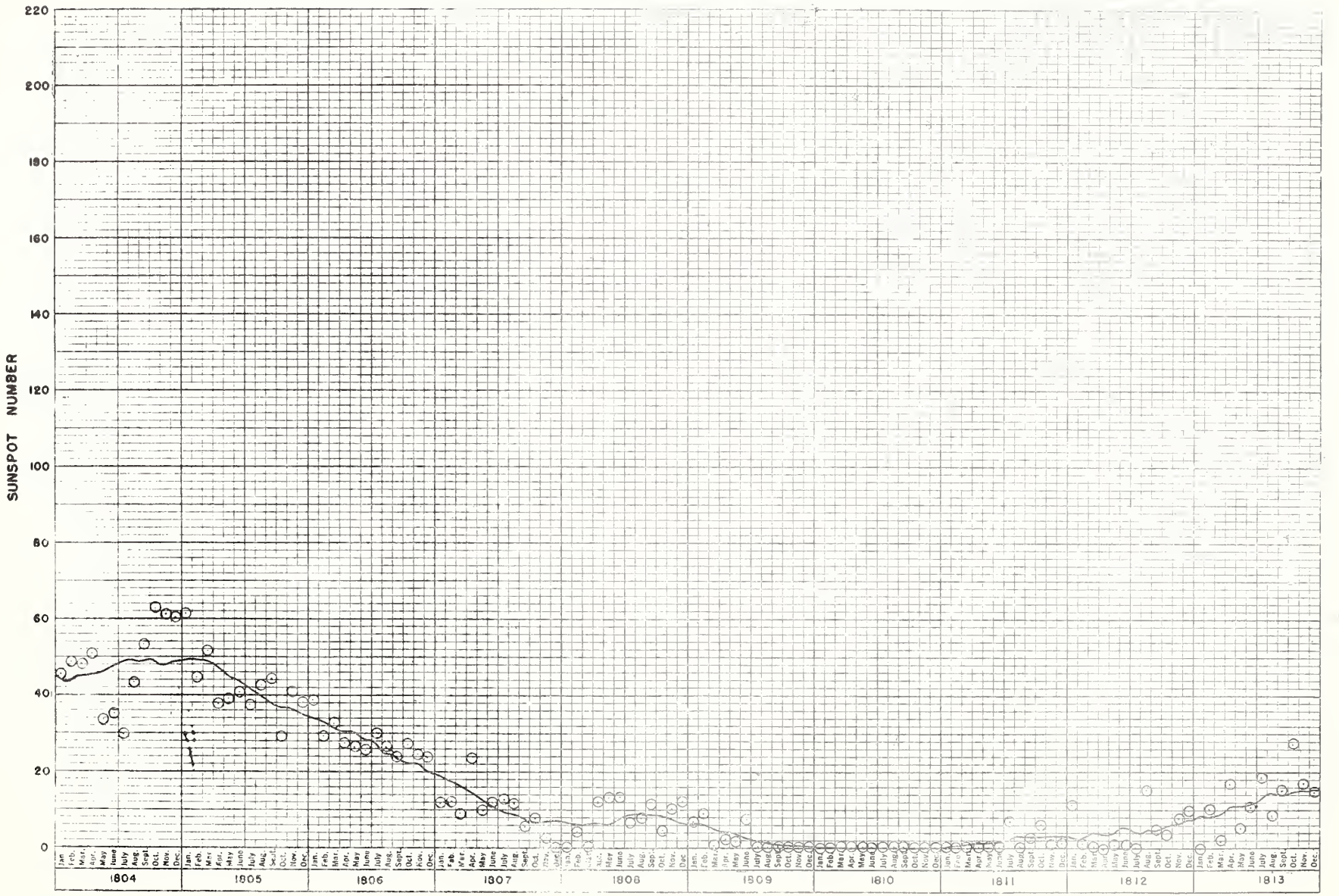
1799
1800
1801
1802
1803

FIG.6.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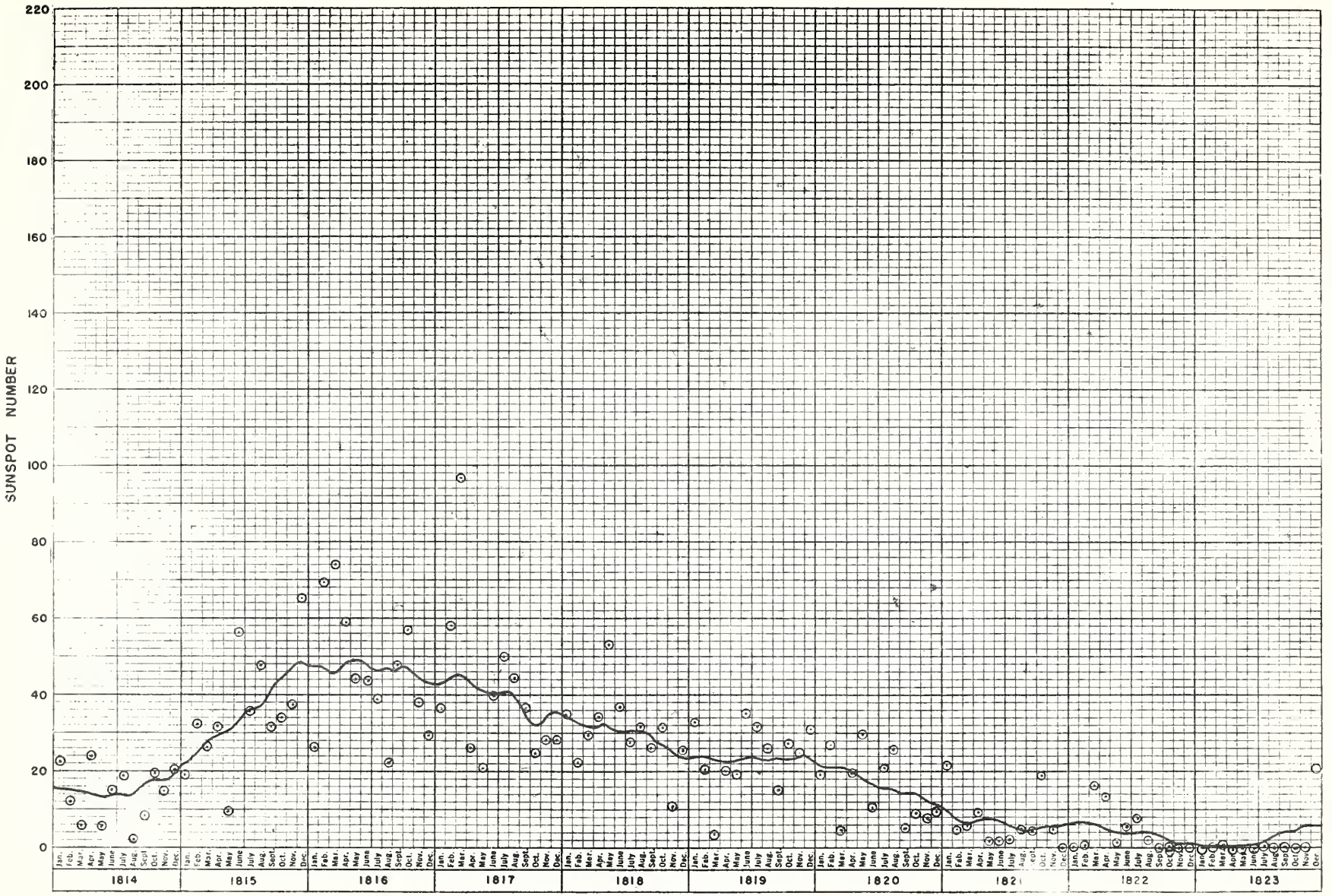
1808
1809
1810
1811
1812
1813

FIG. 7.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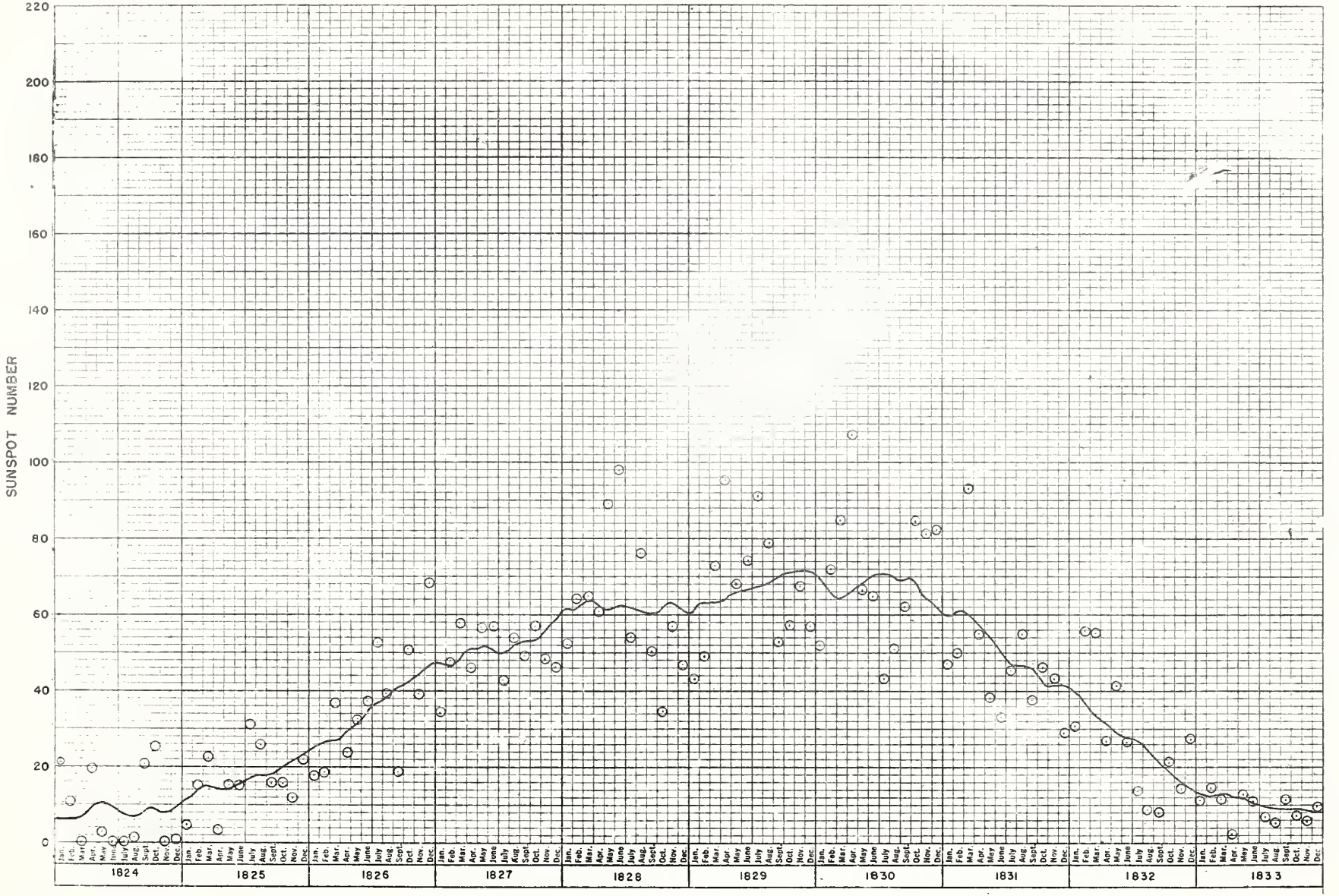
1818
1819
1820
1821
1822
1823

FIG. 8.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180
160
140
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100
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1826
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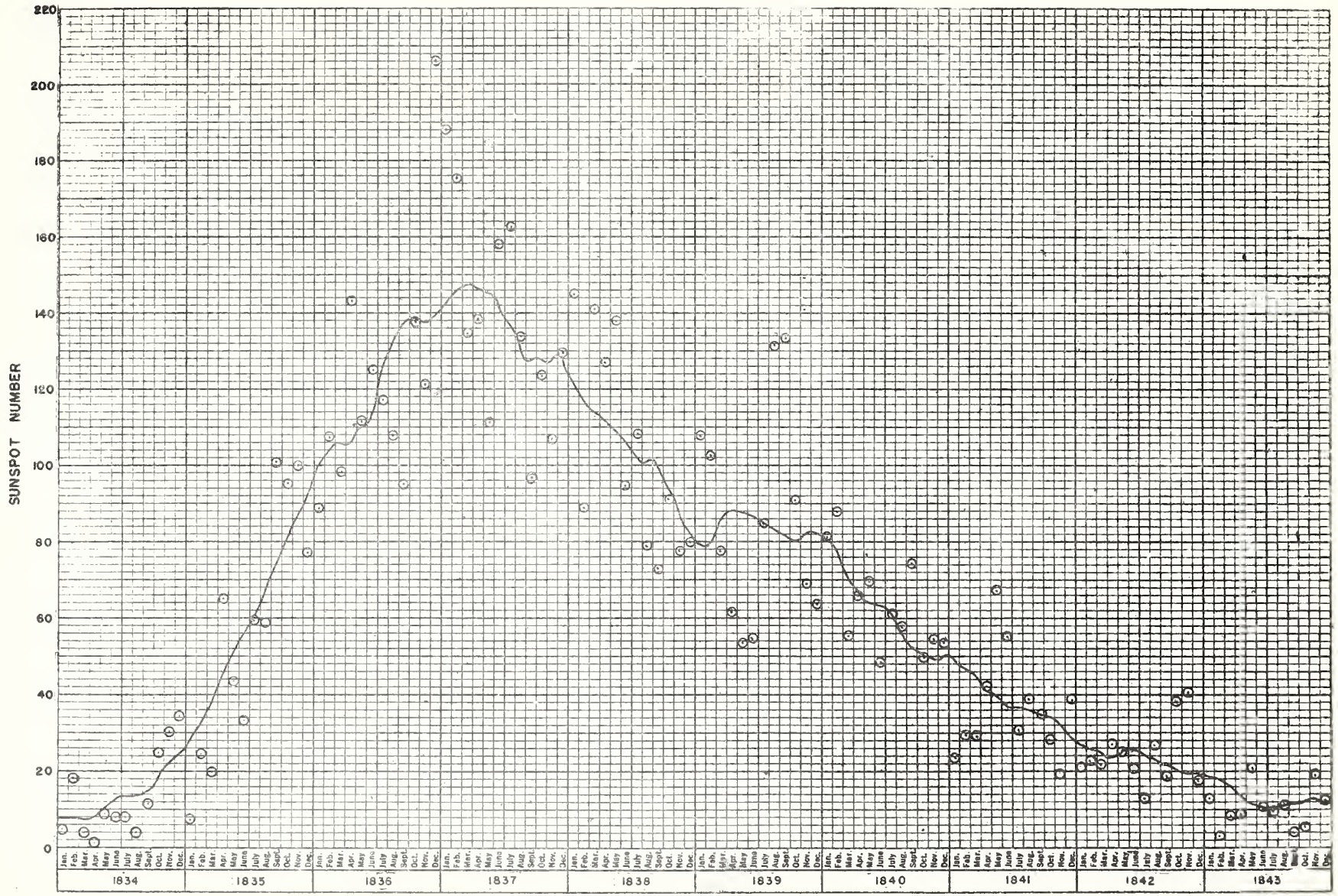
1828
1829
1830
1831
1832
1833

FIG.9.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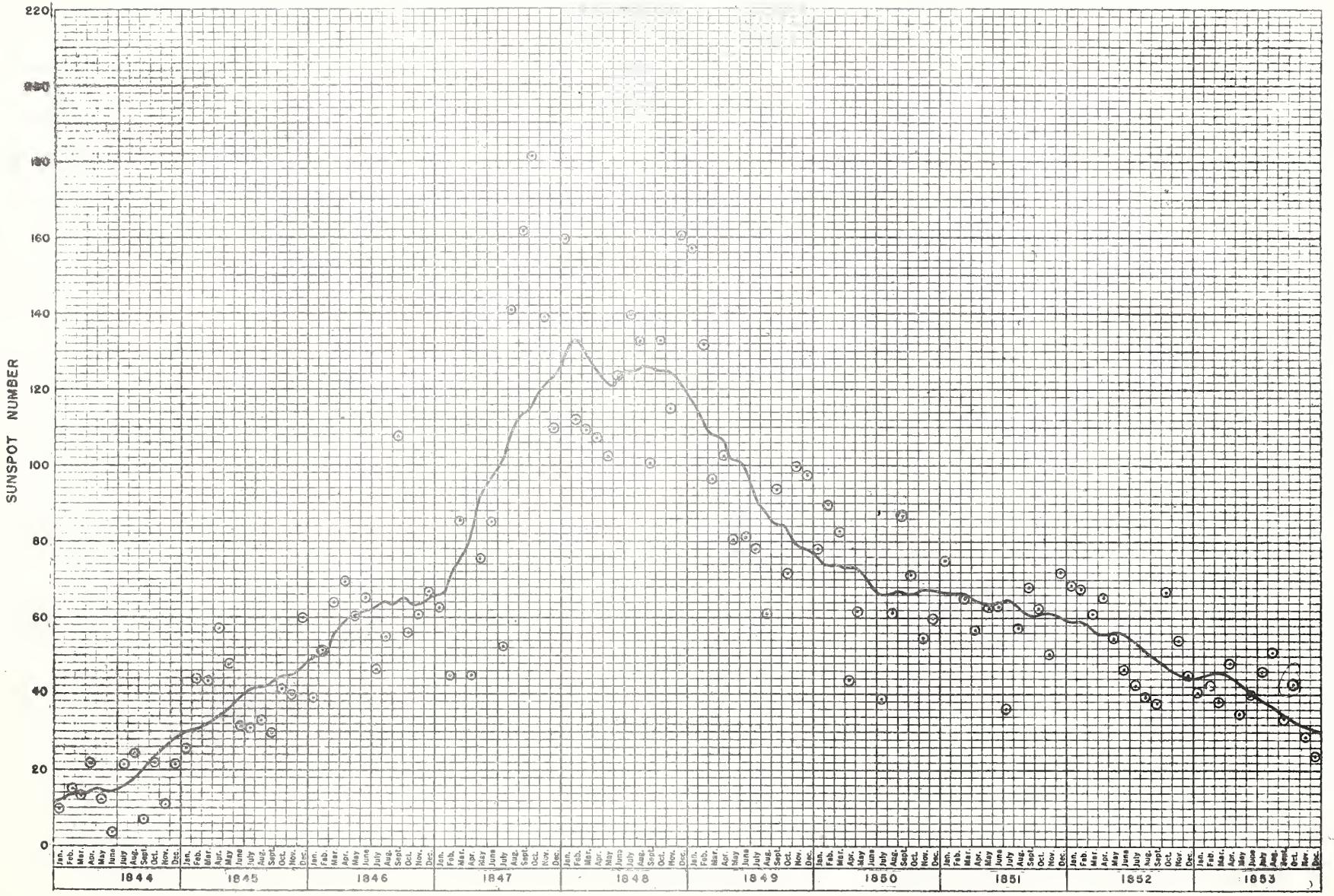
1839
1840
1841
1842
1843

FIG. 10.


SUNSPOT NUMBER
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100
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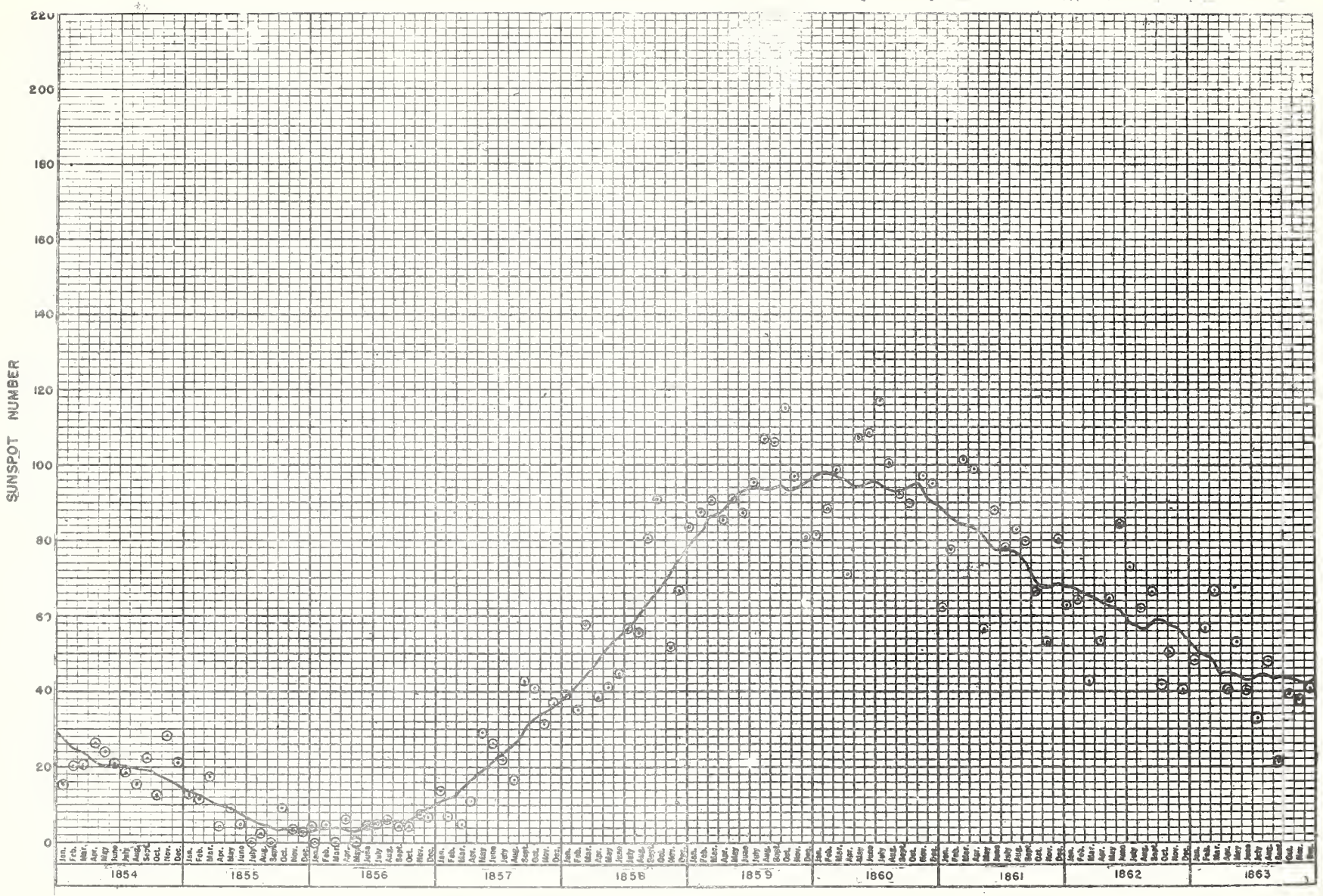
1848
1849
1850
1851
1852
1853

FIG. 11.


SUNSPOT NUMBER
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100
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1856
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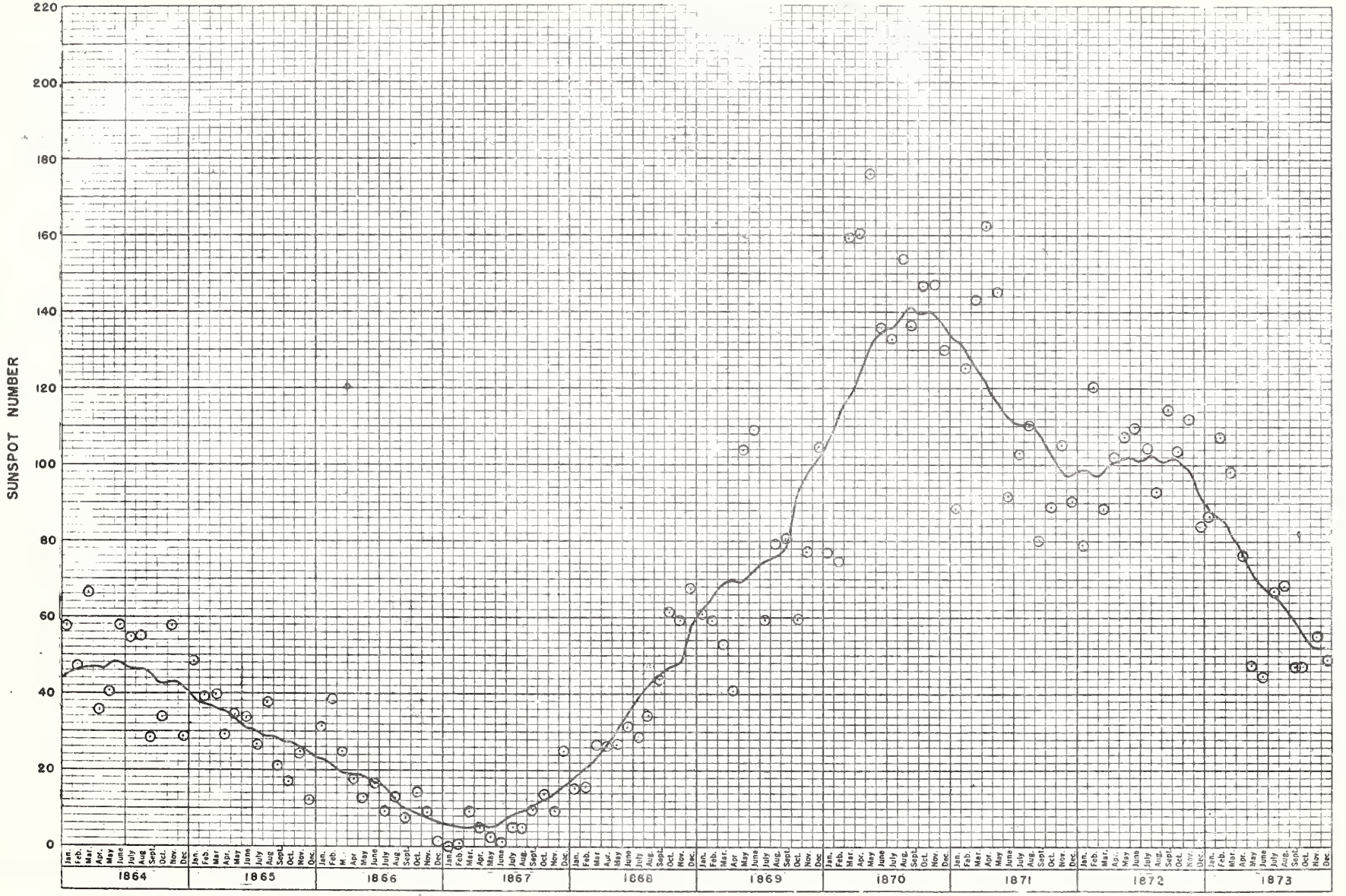
1858
1859
1860
1861
1862
1863

FIG. 12.


SUNSPOT NUMBER
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180
160
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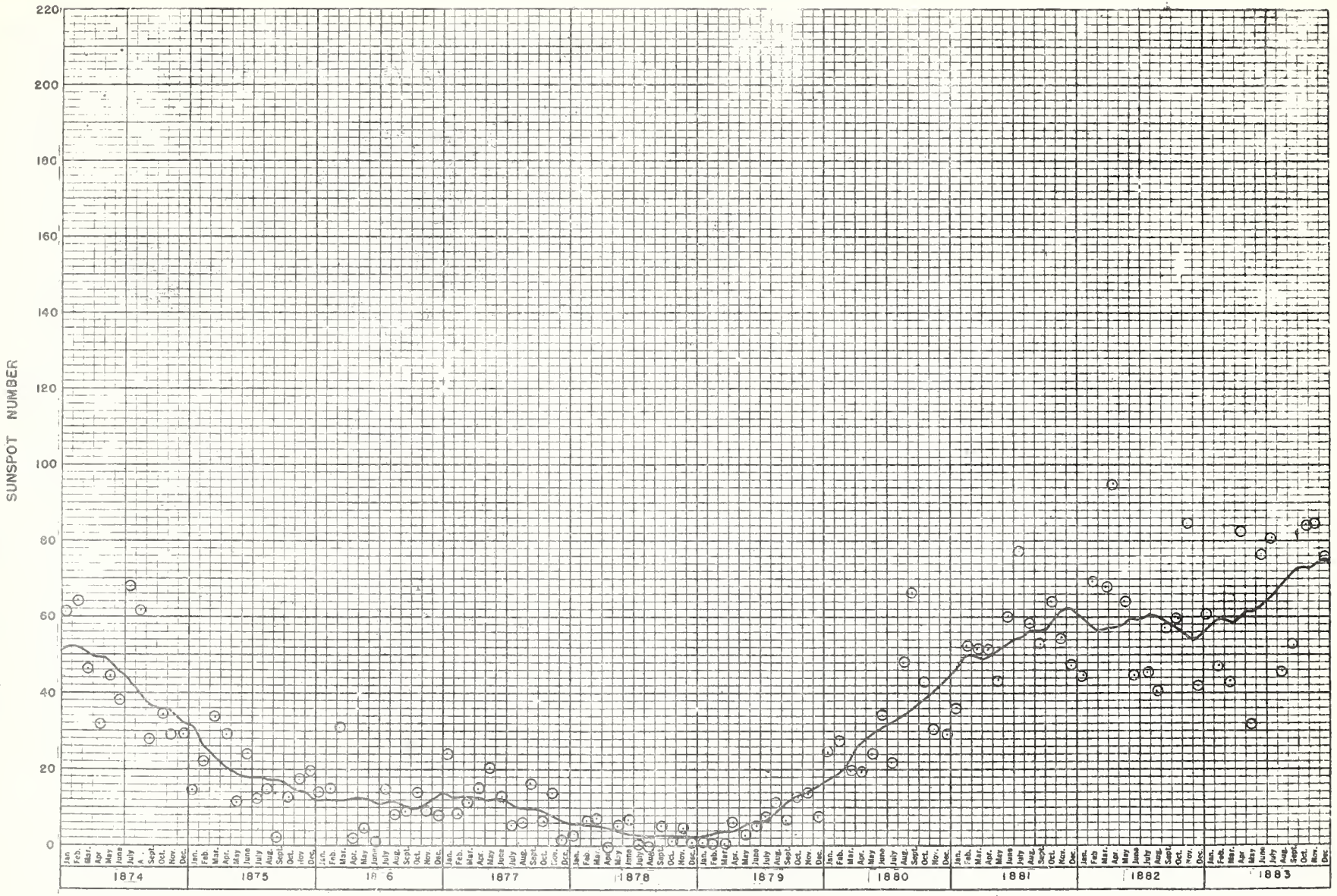
1866
1867
1868
1869
1870
1871
1872
1873

FIG. 13.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100
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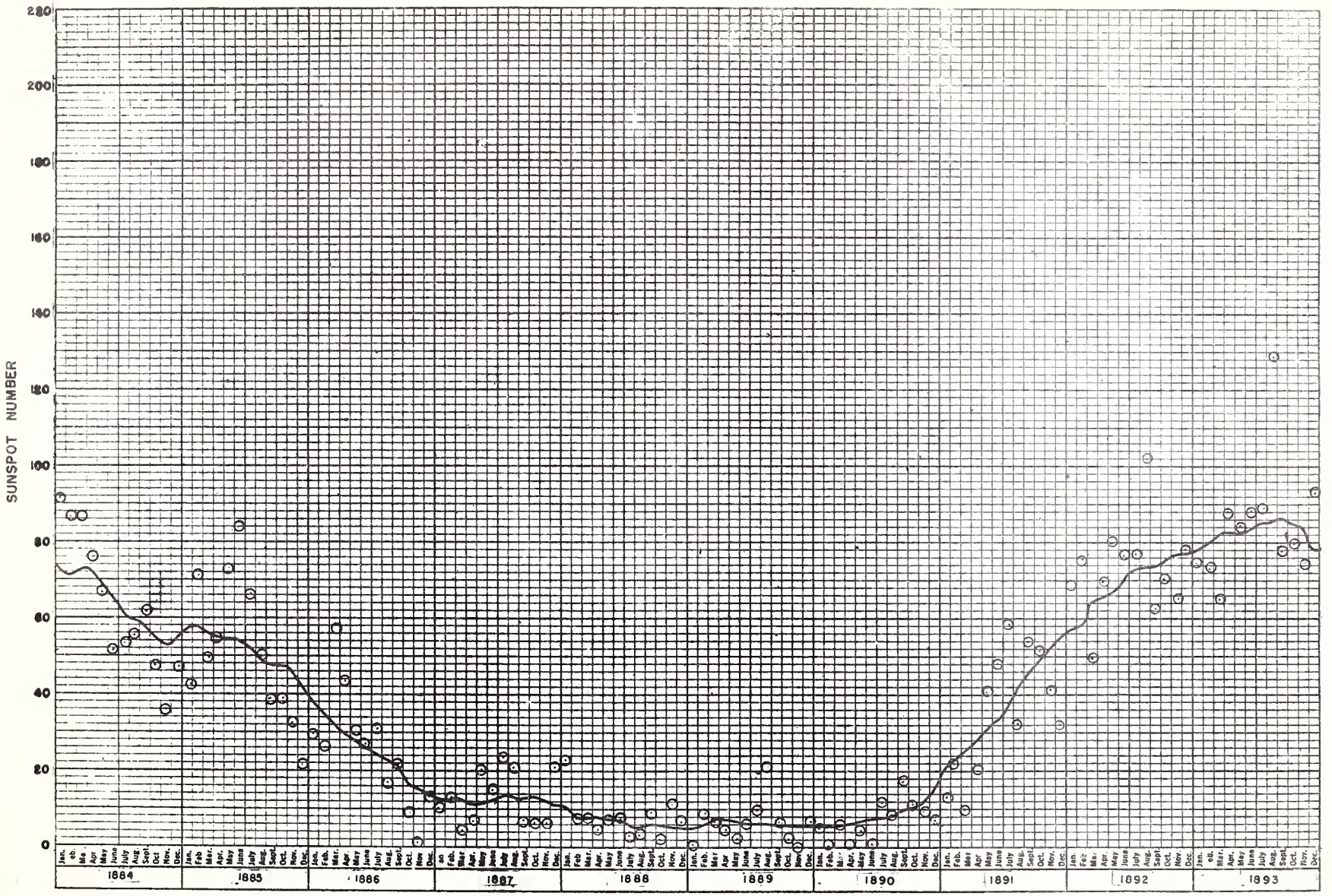
1878
1879
1880
1881
1882
1883

FIG. 14.


SUNSPOT NUMBER
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180
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140
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0
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1885
1886
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1888
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1890
1891
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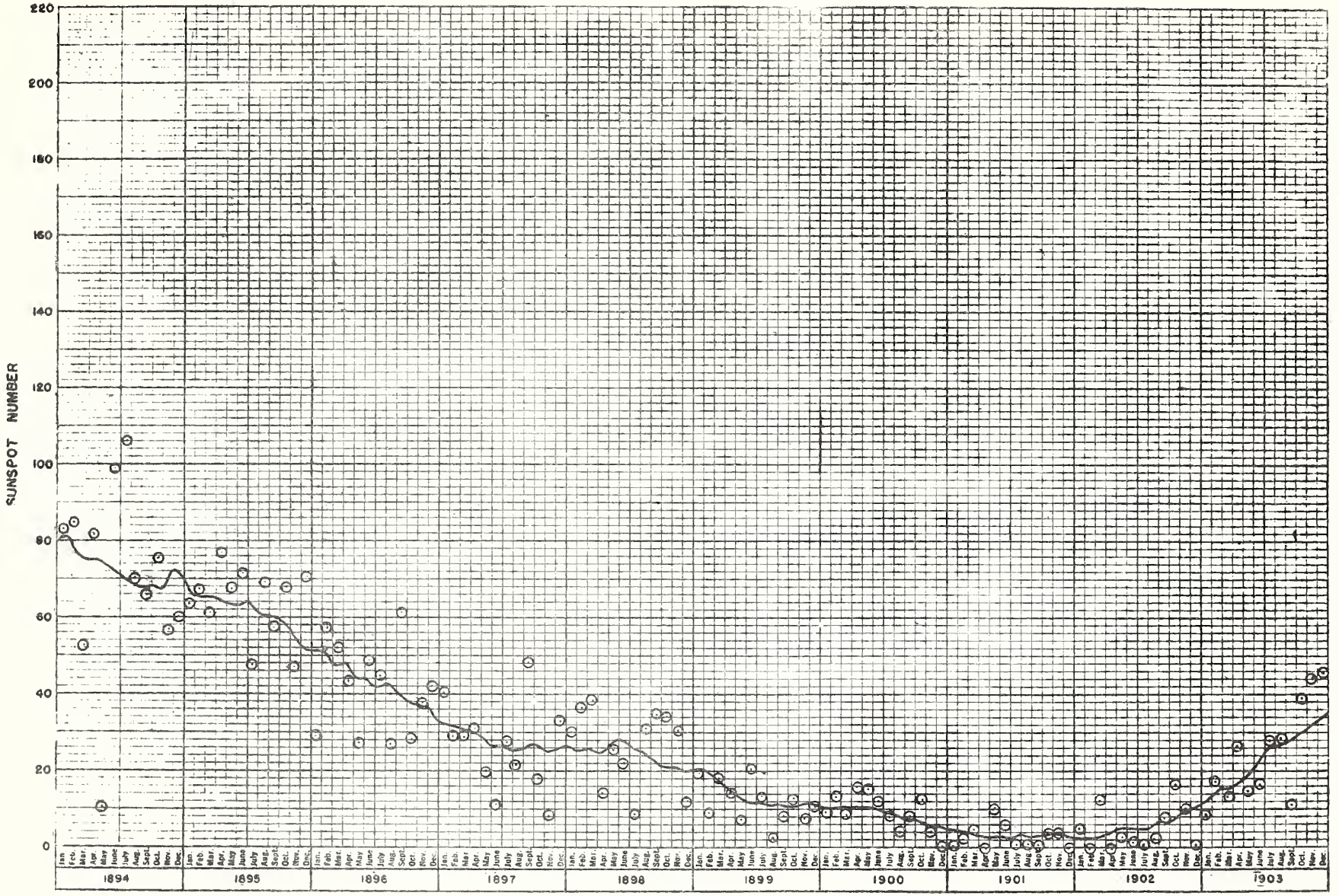
1893

FIG. 15.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1896
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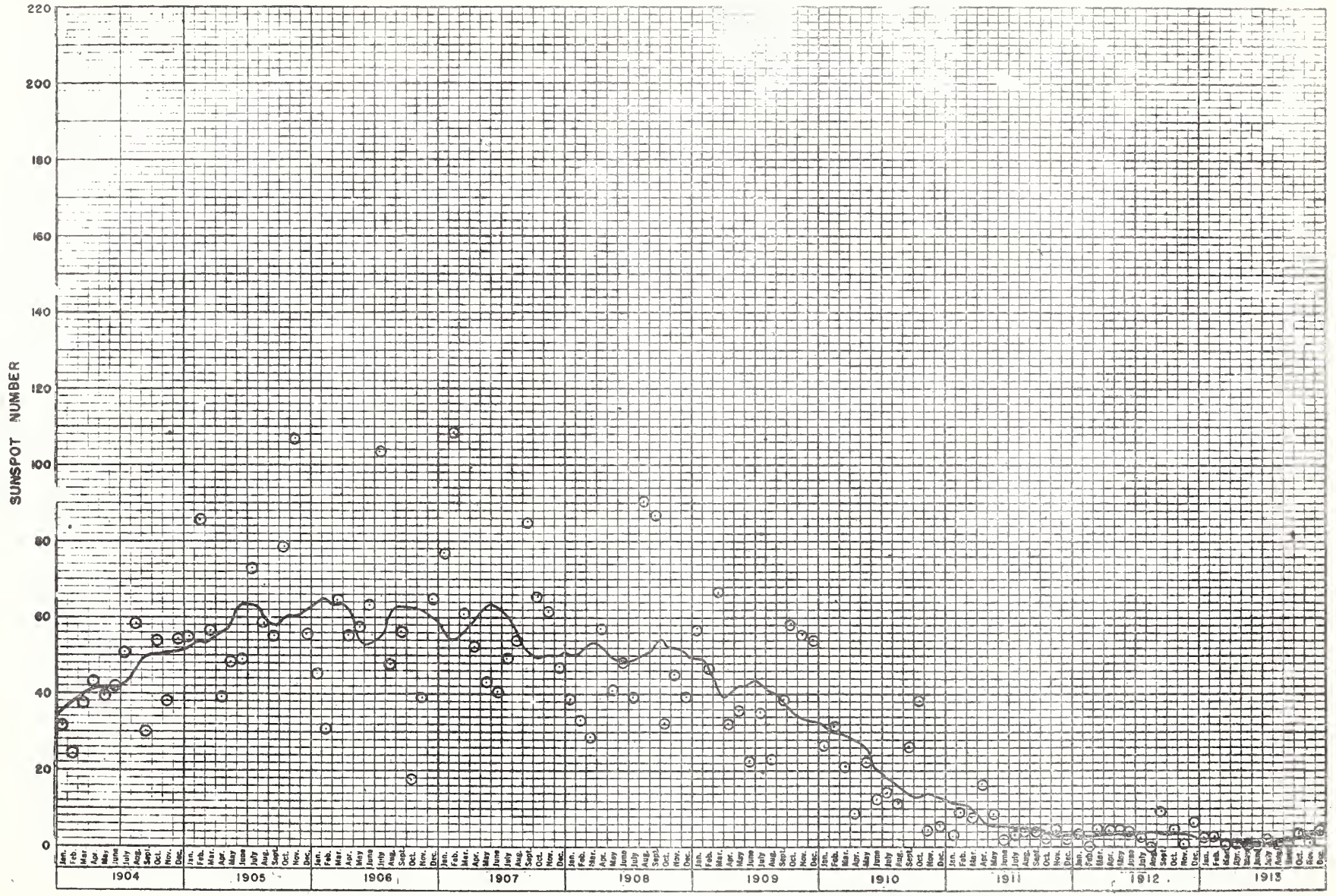
1898
1899
1900
1901
1902
1903

FIG. 16.


SUNSPOT NUMBER
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200
180
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140
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60
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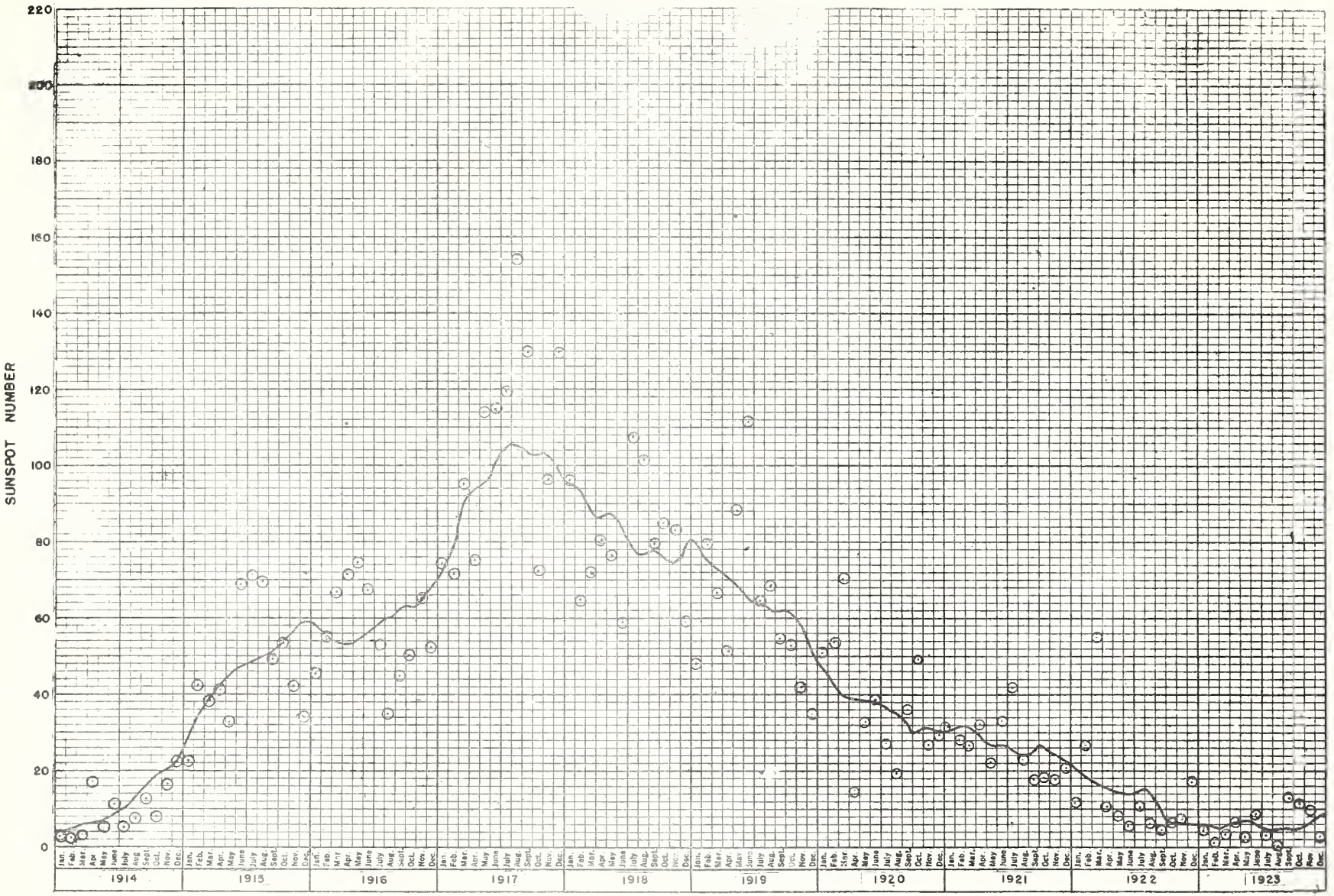
20
0
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913

FIG. 17.


SUNSPOT NUMBER
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180
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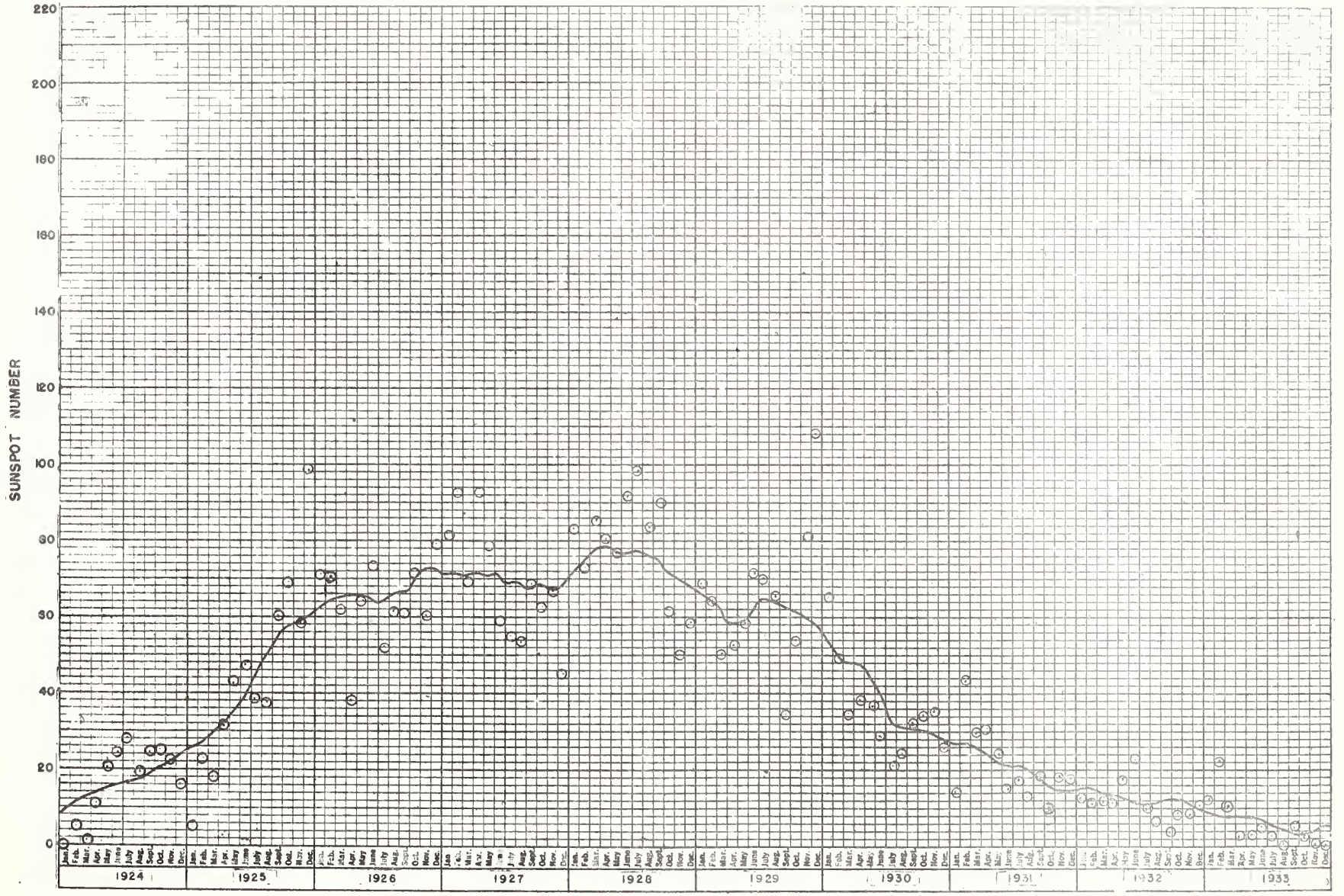
20
0
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923

FIG. 18.


SUNSPOT NUMBER
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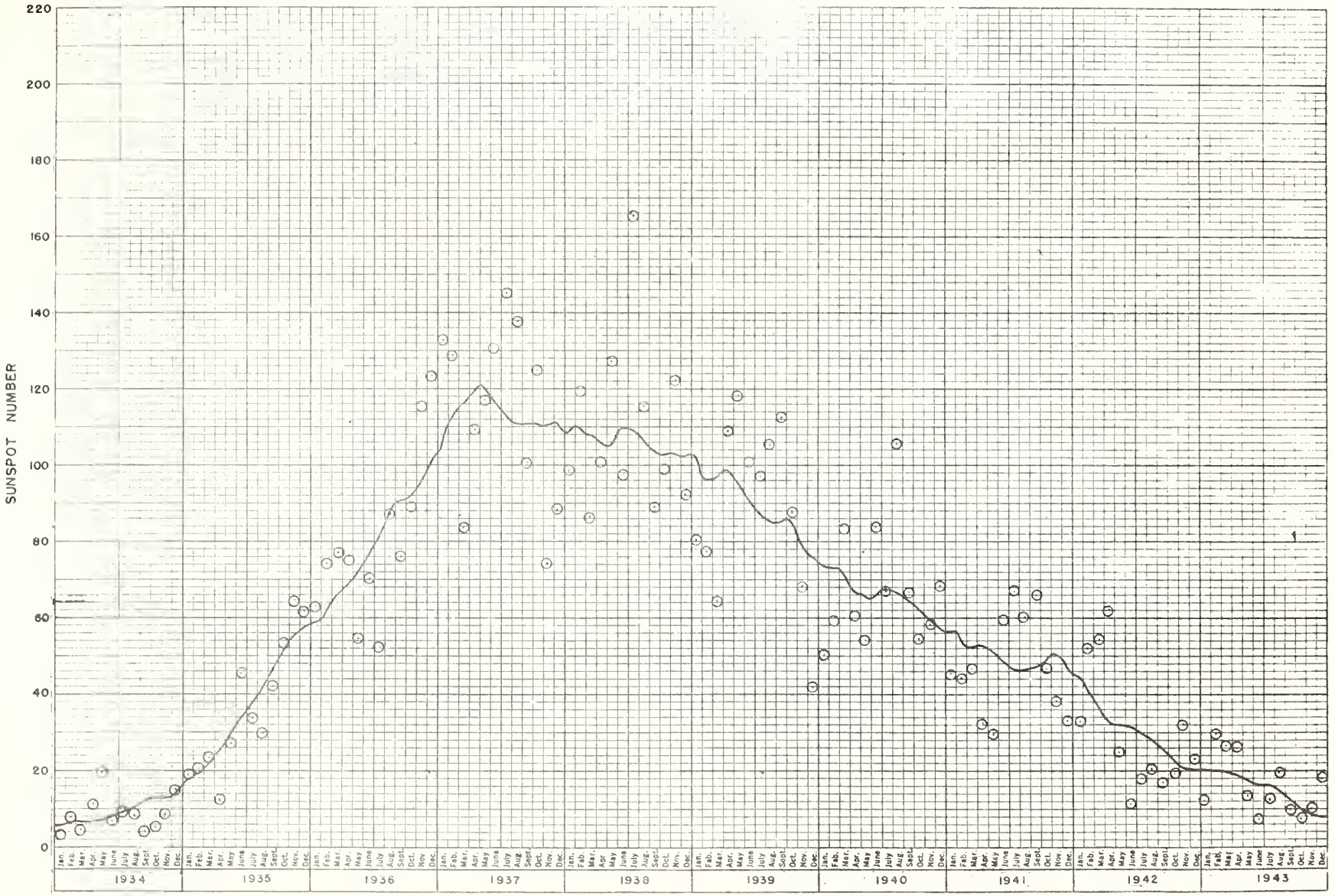
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933

FIG.19.


SUNSPOT NUMBER
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140
120
100
80
60
40
20
0
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943

FIG. 20.

SUNSPOT NUMBER
0
20
40
60
80
100
120
140
160
180
200
220
1944
1945
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.
Sept.
Oct.
Nov.
Dec.

FIG. 21.